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UNIVERSITY OF ALBERTA

BOULDER MONUMENTS OF SASKATCHEWAN

BY

GEOFFREY IAN BRACE

©

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE
OF MASTER OF ARTS

DEPARTMENT OF ANTHROPOLOGY
EDMONTON, ALBERTA
SPRING, 1987

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Director
Archaeological Survey of Alberta

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Archaeological Resource Management Section
Heritage Resources Branch

Date: March 31, 1987

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled Boulder Monuments of Saskatchewan submitted by Geoffrey Ian Brace in partial fulfilment of the requirements for the degree of Master of Arts.

Ruth Gruhn

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Charles Schweger

Date 14 April 1987

ABSTRACT

The archaeological examination of 33 boulder monuments across the southern third of Saskatchewan revealed a variety of prehistoric boulder depictions. Previous monument classification systems described many different outline depictions under one or two all-encompassing categories without attempting to define functional attributes. Better to understand the significance of the wide range of boulder configurations, a system of reclassification encompassing theme variations was devised. To test the system's applicability many other boulder monuments from the northern Great Plains were examined and categorized into the system. Regional boulder monuments were placed in the present most appropriate classes. Each class was divided into subclasses so that depiction varieties might be examined in detail. Ethnographic analogies were suggested for each subclass in an attempt to analyze function for all of the boulder monument configurations. The system will have to be expanded to describe better those subclasses once their individual site attributes are recorded.

All of these boulder monuments are surface configurations where datable substances are rarely encountered. To alleviate the problem of dating a lichenometric analysis was undertaken. Further research into the methodology and applicability is required; however, an initial exploration of the technique has been attempted.

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TABLE OF CONTENTS

PAGE

ABSTRACT iv
ACKNOWLEDGEMENTS v
LIST OF TABLES xiv
LIST OF MAPS xv
LIST OF GRAPHS xvi
LIST OF FIGURES xvii

CHAPTER

I. RESEARCH PARAMETERS 1
  1.1 Introduction 1
  1.2 Construction Observations 2
  1.3 Saskatchewan Boulder Monument Classes 3
  1.4 Research Propositions 5
  1.5 Methodology 7
  1.6 Study Area 13
  1.7 Human Occupation 18
  1.8 Summary 18
II. DATING 20
  2.1 Introduction 20
  2.2 Lichenology Background 23
  2.3 Method 25
  2.4 Problems and Concerns 29
  2.5 Lichenometric Dating 33
  2.6 Lichenometry Analysis 34
  2.7 Comparative Analysis Results 35

PAGE

2.8 Discussion 37

2.9 Summary 41

III. ETHNOHISTORY 42

3.1 Introduction 42

3.2 Algonkian Linguistic Stock 46
  3.2.1 Blackfoot 46
  3.2.2 Cree 46
  3.2.3 Ojibwa 48
  3.2.4 Cheyenne 49
  3.2.5 Arapaho 50
  3.2.6 Atsina 50

3.3 Siouan Linguistic Stock 51
  3.3.1 Dakota 51
  3.3.2 Assiniboine 52
  3.3.3 Hidatsa 53
  3.3.4 Mandan 54
  3.3.5 Crow 54

3.4 Caddoan Linguistic Stock 55
  3.4.1 Arikara 55

3.5 Numic Linguistic Stock 55
  3.5.1 Shoshoni (Shoshone) 55

3.6 Kootenayan Linguistic Stock 56
  3.6.1 Kootenay (Kutenai) 56

3.7 Athabascan Linguistic Stock 56
  3.7.1 Sarcee (Sarsi) 56
  3.7.2 Apacheans 57

3.8 Other Tribes 58

3.9 Discussions 58

3.10 Summary 61

IV. BOULDER MONUMENTS: A RE-EVALUATION 62

4.1 Introduction 62
4.2 Stone Circles 64
4.3 Class I: Medicine Wheels 66
  4.3.1 Subclass A 75
  4.3.2 Subclass B 77
  4.3.3 Subclass C 80
  4.3.4 Subclass D 80

PAGE

4.3.5 Other Medicine Wheels Outside Saskatchewan 81

4.4 Class II. Ceremonial Circles 82
  4.4.1 Subclass A 83
  4.4.2 Subclass B 86
  4.4.3 Subclass C 87
  4.4.4 Subclass D 88

4.5 Class III. Effigy Figures 88
  4.5.1 Subclass IIIa. Animal Outlines 89
    4.5.1.1 Turtle Effigies 89
    4.5.1.2 Badger Effigy 92
    4.5.1.3 Salamander Outline 93
    4.5.1.4 Bison Effigy 94
    4.5.1.5 Other Animal Effigies 95
  4.5.2 Subclass IIIb. Human Effigies 95
    4.5.2.1 Saskatchewan Human Effigies 95
    4.5.2.2 Human Effigies Outside Saskatchewan 99

4.6 Class IV. Geometrics. 100
  4.6.1 Saskatchewan Geometrics 101
    4.6.1.1 Geometric Subclass A 101
    4.6.1.2 Geometric Subclass B 102
    4.6.1.3 Geometric Subclass C 102
    4.6.1.4 Other Geometrics Out of Saskatchewan 103

4.7 Summary 103

V. HISTORICAL SPECULATIONS 106

5.1 Introduction 106

5.2 Dating 107

5.3 Entry Speculations 110

5.4 Distribution of Other Effigy Symbols 112

5.5 Relations to Adena, Hopewell, and Middle Missouri . 114

5.6 Possibilities of Recent Dakota Involvement 116

5.7 Medicine Wheel Analogies 117
  5.7.1 Subclass IA 118
  5.7.2 Subclass IB 120
  5.7.3 Subclass IC 122
  5.7.4 Subclass ID 124

PAGE

5.8 Ceremonial Circle Analogies 125
  5.8.1 Subclass IIA 125
  5.8.2 Subclass IIB 128
  5.8.3 Subclass IIC 129
  5.8.4 Subclass IID 131

5.9 Animal Effigy Analogies 131
  5.9.1 Turtle Effigies 131
  5.9.2 Badger Effigy 133
  5.9.3 Salamander Effigy 134
  5.9.4 Bison Effigy 136

5.10 Human Effigy Analogies 137
  5.10.1 Wildman Butte Human Effigy 137
  5.10.2 Kayville Human Effigy 139
  5.10.3 Dewdney Avenue Human Effigy 139
  5.10.4 Cabri Lake Human Effigy 141
  5.10.5 Human Effigy Discussion 141

5.11 Geometric Analogies 142
  5.11.1 Subclass IVA. Vision Quest Site 142
  5.11.2 Subclass IVB. War Lodge Structure 144
  5.11.3 Subclass IVC. Quarry Site 151
  5.11.4 Other Examined Geometric Sites 152

5.12 Associations of Specific Tribes with Specific Monument Types 154

5.13 Speculated Boulder Monument Varieties by Subclass Analogies 156

VI. CONCLUSIONS 159

6.1 Summary 159

6.2 Consideration of the Initial Propositions 159

6.3 Discussion and Conclusions 164

FIGURES 167

REFERENCES 241

APPENDIX I. LICHENOMETRIC THALLUS MEASUREMENTS 264

APPENDIX II. ARTIFACT ANALYSIS 293

LIST OF TABLES

Table PAGE

1. Lichenometry Dates 36

2. Important Attributes of Saskatchewan Boulder Monument Sites 65

3. Saskatchewan Medicine Wheel Spoke Angles and Number of Boulders/Spoke 68

4. Saskatchewan Medicine Wheel Natural and Cultural Attributes 78

5. Non-Saskatchewan Medicine Wheels 79

6. Saskatchewan Ceremonial Circles 84

7. Ceremonial Circles Outside Saskatchewan 85

8. Animal Boulder Monuments on the Northern Great Plains 90

9. Northern Great Plains Human Boulder Outlines 97

10. Boulder Monuments Dated by Artifact Association, Radiocarbon, or Historic Reference 108

11. Northern Great Plains and Neighbouring Geometrics 145

12. Artifact Analysis 295

13. Artifact Dimensions, DkOe-2 297

14. Artifact Dimensions, DkOj-2 302

15. Artifact Dimensions, EaNh-7 305

LIST OF MAPS

Map PAGE

1. Northern Great Plains area of Boulder Monument Occurrence and Major Physiographic Features 14
2. Saskatchewan Bedrock Geology and Surface Landscape . . 15
3. Saskatchewan Soils, Vegetation, and Climate 17
4. Northern Great Plains Tribal Distributions 47
5. Saskatchewan Boulder Monument Locations and Border Zones 67
6. Boulder Monument Locations on the Northern Great Plains 126

LIST OF GRAPHS

Graph PAGE

1. Rock Pile Dates (_Dimelaena oreina_) 39
2. Dated Cemetery Headstones (_Dimelaena oreina_) 39
3. Saskatchewan Medicine Wheel Spoke Angles 72

LIST OF FIGURES

Figure PAGE

1. DgMn-3 (1) Oxbow Medicine Wheel Complex 168
2. DiMv-2 Halbrite Medicine Wheel 169
3. DhOb-2 Canuck Medicine Wheel 170
4. EeNg-1 Jelly Ranch Medicine Wheel 171
5. EaOs-2 Suffield Medicine Wheel 172
6. EfOp-58 Rinker Medicine Wheel 172
7. DgMn-3 (3) Oxbow Medicine Wheel Complex 173
8. DkMq-2 Moose Mountain Medicine Wheel 174
9. DlOv-2 Grassy Lake Medicine Wheel 175
10. EcOp-4 Suffield Experimental Medicine Wheel 175
11. EgOx-1 Suitor Site No. 1 176
12. ExOx-29(1) Suitor Site No. 2, Wheel No. 1 176
13. EgOx-29(2) Suitor Site No. 2, Wheel No. 2 177
14. EfOo-10 Minor No. 1 177
15. 24TT67 Sun River Medicine Wheel 178
16. Custer County Boulder Outline 178
17. DgNf-3 Doug Wade Medicine Wheel 179
18. ElOd-2 Plenty Medicine Wheel 180
19. DhNg-1 Big Muddy Bird Foot Effigy 181
20. EeNe-14 Wilson Russel Medicine Wheel 182
21. Steel Medicine Wheel 183
22. DiPi-2 Wolfchild Medicine Wheel 183
23. EkPe-3 Ziegenbein Medicine Wheel 184
24. 24BH220 Fort Smith Medicine Wheel 184

Figure PAGE

25. 24BH747 Grassy Knoll Site 184

26. DkPf-1 Many Spotted Horses Medicine Wheel 185

27. EbOm-1 Many Island Lake Medicine Wheel 185

28. EgOx-46 Hutton Medicine Wheel 186

29. 39HD22 Jennings Site 186

30. EePl-2 Jamieson's Medicine Wheel 187

31. EdPc-1 Majorville Cairn and Medicine Wheel 187

32. 48BH302 Big Horn Medicine Wheel 187

33. Birch Bark Scroll 188

34. DgMn-3, feature 2 Oxbow Medicine Wheel Complex 189

35. EgNx-1 Hughton Medicine Wheel 190

36. EfOl-2 Roy Rivers Medicine Wheel 191

37. DgOp-38 192

38. DhPb-2 Antelope Hill 192

39. EdOp-1 British Block Cairn Medicine Wheel 192

40. EfOq-36 Anderson No. 1 Medicine Wheel 192

41. EfOq-65 Anderson No. 2 Medicine Wheel 193

42. EaPe-1 Sundial Hill Medicine Wheel 193

43. EgPn-53 Barry Medicine Wheel 193

44. DhMn-9 Alameda Ceremonial Circle 194

45. DjMr-1 Forget Ceremonial Circle 195

46. EaNh-7 Claybank Ceremonial CIrcle 196

47. EeNu-1 Perrin Ranch Stone Circles 197

48. Dand Circle 198

49. Morstad Site 198

50. Alonsa Site 199

Figure PAGE
51. DkLw-18 199
52. DiNf-1 Ogema Stone Circle 200
53. FbNp-2 Cronk's Big Circle 200
54. EfOo-24 Minor No. 3 Medicine Wheel 201
55. EhOp-1 Buffalo Bird Medicine Wheel 201
56. EpOo-10 Minor No. 2 202
57. EkPf-1 Rumsey Cairn and Medicine Wheel 202
58. EdOq-30 Byrne's M40 Medicine Wheel 203
59. DgNg-2 Dick Giles Circle 204
60. EfOl-2 Roy Rivers Medicine Wheel (1915) 205
61. DgNg-1 Pat Giles Turtle 206
62. DiNe-1 Hardy Turtle 207
63. Consort Turtle and Snake 208
64. EaKv-3 Bannock Point Site 208
65. EaKv-12 Rainbow Falls 209
66. EaKv-13 Basket Falls 209
67. 39HU70 Hughes County Effigies 210
68. 39HU74 Hughes County Effigies 210
69. Jerauld County Boulder Outline 211
70. Minnehaha County Effigies 211
71. North Dakota Turtle 212
72. DhNe-2 Minton Turtle Effigy 213
73. DiNs-1 Mankota Salamander 214
74. DgNh-3 Big Beaver Buffalo Effigy 215
75. EaKv-14 Tie Creek Site 216
76. EaKv-17 Pine Point Snake Site 216

Figure PAGE

77. EaKv-20 Pine Point Linear 217

78. Lac du Bois 217

79. EaLa-6 Fred Sieg Farm 217

80. Boulder Outline Custer County 218

81. Minnesota Bison Effigy 218

82. Ojibwa Hunting Song 219

83. DgNc-1 Wild Man Butte Human Effigy 219

84. DkNg-2 Kayville Human Effigy 220

85. EcNh-1 Dewdney Avenue Human Effigy 221

86. EgOk-1 Cabri Lake Human Effigy 222

87. EfOs-36 Ross Medicine Wheel 223

88. EkPf-1 Rumsey Cairn Medicine Wheel 223

89. Consort Human Effigy 224

90. Cluny Human Effigy 224

91. Steveville Boulder Outline 225

92. EaKv-14(1) Tie Creek Site 225

93. EaKv-14(4) Tie Creek Site 226

94. 24GA106 Bozeman Human Effigy 226

95. Pryor East Site 227

96. Landslide Butte 227

97. Wessington Springs 227

98. Punished Woman's Hill 228

99. tuyan-witchashta-karpi 228

100. DkOj-2 Lawrence Ranch Vision Quest Site 229

101. DgPn-28 The Burmis Boulder Paving 230

Figure PAGE

102. DgNf-5 Marg Giles Effigy 231
103. DkOe-2 Bone Creek Effigy 232
104. EaKu-7 Jessica Lake Portage Site 233
105. EaKu-8 Jessica Exit Site 233
106. EaKu-9 Molloy Lake Site 234
107. EbKu-9 Astwood Petroforms 234
108. EaKv-14(2) Tie Creek Site 235
109. EaKv-14(3) Tie Creek Site 235
110. EaKv-14(6) Tie Creek Site 236
111. EaKv-21 White Lake Site 236
112. EgKx-15 The Thunderbird Site 237
113. CbGu-1 Palframan Site 237
114. CbGu-2 Palframan Site 238
115. CcGs-1 Talon Lake Rock Structure 238
116. 24PH70 A. C. Marshall Site 239
117. 48FR302 Hadsell Ranch Rock Figure 239
118. Custer County, Scinger Ranch Figure 240
119. Custer County, Boulder Outline 240
120. Custer County, Sampson Ranch 240

CHAPTER I

RESEARCH PARAMETERS

1.1 Introduction

A boulder monument is a man-made outline, formed of medium-sized glacial boulders laid on the prairie surface. These outlines consist of circles; straight and curved lines; anthropomorphic and animal figures; geometric designs; and line, circle, and cairn combinations.

On the Great Plains, boulder monuments are scattered from central Saskatchewan and Alberta to northern Wyoming and central Nebraska. Other boulder monuments are observed along the foothills and mountain areas of Idaho and Montana; and along and within the mixed forest areas of Manitoba, Ontario, and Minnesota. One feature common near most of these monument sites are stone circles (tipi rings), evidencing habitation (Kehoe 1954, Finnigan 1982, Graspointner 1980). The conjunction of habitation remnants with some monuments may indicate a communal intention. An individual significance may be surmised where the monument is the single feature observed. In all cases the majority of the available boulders have been re-arranged to construct the various monuments and related features, leaving definite evidence of purposeful formations.

The primary question of boulder monuments asks, what do they represent? Are they ceremonial remnants, border/trail markers similar to the rock constructions used by early hunters and as taught among groups such as the Boy Scouts; or are they remnants of children's games? And finally, if any or all of these features are related to plains Indian culture, can their purpose or function be identified by reviewing ethnohistorical accounts, surveyors' records, and Indian mythologies?

Previous investigators have defined some of the boulder monuments as "medicine wheels" (Dempsey 1956, Grey 1963, Kehoe 1973), "stone monuments" (Lewis 1889, 1890), "boulder mosaics" (Todd 1886), and "vision quest structures" (Fredlund 1969, Carmichael 1979). Others (Eddy 1975, Kehoe and Kehoe 1976) view some of them as being astroarchaeological or calendrical recording systems. This disparity of definition, also noted by Eddy (1979:153), prompted me to design a classification scheme whereby these monuments might be described better and analysed by reference to the cultural phenomena to which they seem to pertain.

1.2 Construction Observations

Boulder monuments are constructed of glacial drift boulders and rock slabs which are readily available on the prairie surface. Individual boulders range in size from approximately 0.15 m^3 to 0.50 m^3, with an overall average size approximating 0.30 m^3. The boulders are generally regular in their exterior features; and are elliptical, trianguloid, rectanguloid, or cuboid in shape. The more common rock types used for boulder monument construction are metamorphic (quartzite) and igneous (granite) rock, with sedimentary rocks (limestone, dolomite, shale, sandstone, and conglomerates) representing the least used varieties.

Some boulder monuments have cairns (boulder piles) in their design patterns, though the majority of the outlines consist of individual boulders laid into arrangements on the prairie surface. The rearrangement of the surface boulders into possible cultural-related patterns was a minor alteration of the virgin prairie. Some of the boulders appear to be deeply imbedded into the soil matrix, a fact which may suggest site antiquity or local soil accumulation. All exposed areas of the boulders possess colonies of lichens.

1.3 Saskatchewan Boulder Monument Classes

Because of the disparity of monument definition noted by myself and others, these features were grouped by this thesis into four broad classes, which display similar configurations. By this approach common features might more readily be compared to the accounts recorded in journals, records, and modern native lore.

Class 1. Medicine Wheels are those features which possess three or more boulder lines radiating away from a central area (cairn, circle, or unmarked point) where the difference in the line angles is not less than 160 degrees between the two most extreme angles. The boulder lines (or spokes of the medicine wheel) are single layer boulders, usually aligned with the longitudinal axis of the boulders along the line. Spoke lengths are variable both at and between medicine wheels. Additionally, medicine wheels in Saskatchewan vary from a minimum 44.8 metres at DhOb-2 to a maximum 143.6 metres at DhNg-1 across their longest individual diameter. These spokes are a single boulder in width. Medicine wheels may possess a central cairn, central transected boulder circle, peripheral boulder circle, minor cairns at the ends of the radiating spokes, or just lines of boulders radiating from a central area.

Class 2. Ceremonial Circles include boulder circles which are in excess of 15 metres in diameter, although one 7 metre diameter boulder circle was included in this category because of other characteristics. In Saskatchewan the largest ceremonial circle (EaNh-7) has an average diameter of 36.1 metres (the north-south diameter measured 39.9 metres, whereas the east-west diameter measured 32.3 metres). These features may possess a central cairn, interior small cairns, a single interior line, two or three exterior lines which articulate with the feature's exterior outline at a definite entranceway at one point in the circle's circumference (where the differences in boulder line directional angles are not in excess of 45 degrees between the two most extreme pointing lines), or a double encompassing boulder circle.

Class 3. Effigy Outlines include both animal figures and anthropomorphic patterns. Animal outlines may be further subdivided into genera. Anthropomorphic outlines generally depict gender; however, sex determination is tenuous for the animal outlines.

Class 4. Geometric Mosaics in this study consist of two broad groups of boulder features: (a) those observed and mapped in Saskatchewan, which by their design attributes may propose cultural phenomena; and (b) those outside Saskatchewan which were not observed by this author, have never been mapped (or the illustrations have not been published), or have not been described by other researchers beyond a "mosaic" or "effigy" classification. In Saskatchewan three features have been classified as geometric mosaics. Two of these figures have circle and line boulder patterns, while the third has three boulder lines together with an earth and boulder arc. The variability of these figures precludes any generalizations of construction for all the features includes in this category.

In Saskatchewan the four classes encompass 33 recorded boulder monuments on 30 sites across the southern third of the province. Eight other sites have been reported, of which one was destroyed before it could be examined, three were reported by a pipeline survey but could not be located; and an additional four sites were reported in 1983 and 1984 but were not included as they were not studied sufficiently to enter them into this text.

1.4 Research Propositions

The propositions discussed in this thesis were formulated from previous personal research, analogy, speculation, ethnographic sources, and historical accounts. These propositions were considered as an attempt to provide perception of the cultural aspects responsible for the construction of boulder monuments, and as methods to date those constructions.

The propositions relate to the probable tribal origin of boulder monuments, possible symbolism, a revised classification scheme, and the possible era(s) of individual feature construction. A number of sub-hypotheses are presented as substantiations of the scope of each hypothesis.

The first proposition is that the boulder monuments observed on the North American Great Plains represent the work of different tribes. It is possible that different boulder monuments by class and subclass can be linked to specific tribes; and also tribal culture borrowing may be reflected in some boulder monument configurations.

A second proposition is that boulder monuments located on different landscape elevations reveal native perceptions of plains environment conditions, personal achievement (boasting) commemoration, or tribe/band occupation memorials, where

a. personal achievement (boasting) memorials may be located prominently on the landscape in association with a single stone circle;

b. group ceremony boulder monuments may be associated prominently with many stone habitation circles; or

c. special ceremony memorials may be located prominently away from stone circles.

A basic premise of this study is that boulder monuments can be subdivided (reclassified) into classes to describe them better and ultimately to propose better functional uses. Ethnographic analogy and current native accounts might be comparable with boulder monument subclasses; and additional analysis may yield different, viable hypotheses of possible boulder monument use/meaning.

Finally, I propose that the radial growth of lichens, as a biological manifestation on exposed boulder monument surfaces, presents the opportunity to date these features by lichenometry. This study will attempt to ascertain whether lichenometry can be applied to surface features on plains archaeological sites; or whether environmental and human-induced conditions limit the practicality of lichenometric dating of boulder monuments in plains environments.

A variety of analytical procedures was used to consider these propositions. Saskatchewan boulder monument sites were compared with each other, within each of the classes, and with all other Great Plains boulder monument illustrations. This comparison led to the definition of individual subclasses within each of the monument classes (see Chapter IV). The subclasses for each class were then used as the basis for comparisons with ethnographic, historic, and current illustrations and narratives. Additionally, other native North American symbols and cultural residential-organization patterns were compared with all subclasses.

These examinations were initiated following a review of all known and suspected plains tribes and of the suspected districts vacated by these migrating people. This analysis was promoted in a search for possible symbolism within the vacated areas as comparable with these plains monuments. To facilitate analysis, speculations of possible cultural similarities were derived from each subclass - regardless of the number of attributes in each subclass.

As these examinations all pertain to surface configurations, a method attempting to date only exposed boulder surfaces was initiated. This method was attempted with the expectations that, if successful in Saskatchewan, it could be utilized to date all bordering plains boulder monuments.

1.5 Methodology

Thesis research was divided unequally among field work, literature searches, and personal correspondences. Field research occupied May to October of 1980, plus two weeks during June 1981; and many weekends during July to November in 1981, 1982, and 1983. Literature searches were initiated during 1979-1980, and continued in earnest in October of 1980. Personal correspondence revealed the majority of non-Saskatchewan site locations, with the major (by volume) contributions obtained from regional government registrars, private contractors, and independent researchers. The remainder of the non-Saskatchewan site information was obtained from various anthropological and archaeological journals, newsletters, and texts. The initial Saskatchewan site information was obtained from the Saskatchewan Museum of Natural History's (SMNH) archaeological site files and from the Saskatchewan Archaeology Newsletter (SAN). Additional information was obtained from many friends, cited in the acknowledgements.

Lengthy field research during the initial period was necessary because the site information available in SMNH files was incomplete for my purposes. With few exceptions, all site records focused on the central boulder monument; and gave only sparse information about additional site characteristics. Stone circles, for example, were noted as present; but were not counted, located, or measured. Descriptions of local environmental aspects were restricted to the distance from a permanent water source.

The 1980 field research was conducted in two stages. During May to July all sites were resurveyed without an assistant. This work permitted me to define site perimeters and make preliminary site maps using transit and tape measurements. All associated prehistoric features were referenced by horizontal angles and distances to the central boulder monument, which was referenced to existing legal municipal grid designations by transit triangulation. All boulder monument angles were recorded from a magnetic north zero line. In this manner true north and other angles could be corrected by computing true north from the National Topographic Series (NTS) 1:50,000 maps. My initial survey permitted establishment of survey reference points, and allowed for locating legal bench marks and survey pins. These survey points were located to establish ready datum points for the second research stage, when a rod-chain person was hired to assist with accurately measuring elevations and horizontal distances. The reference points (0.02 m x 0.05 m wooden hub stakes) were placed immediately adjacent to the central boulder monuments at each site. One stake was always located on the north edge of the feature, and the second on the edge aligning a magnetic north-south base line. Both hub stakes were driven into the sod so that the tops were flush with the ground. In this manner they could not be easily removed or displaced. The tops of the stakes were marked with indelible ink so that they might be relocated easily. Also, the solid wooden mass permitted accurate replacement of metal survey pins for reference lines.

Five newly reported boulder monuments were mapped during the 1980 summer survey. One previously reported feature was remapped during the 1982 season, as the original notes (ca. 1965) could not be located. Mapping of boulder monuments was performed using a one square metre wooden frame strung at 0.20 metre intervals, after the method employed by Bayrock (1963:1-2).

Habitation circles were measured (outside diameter) using a 15 metre steel pocket tape. Cairns and fire hearths were similarly measured. All three feature types were marked with flagged lathe (0.01 m x 0.04 m x 1.0 m wooden stakes) so that they might be referenced on the preliminary map. During the second research stage the early map was an invaluable tool for relocating those features (as the lathe stakes were removed from each site after the initial survey was completed).

Landowners were personally contacted prior to site examination, to learn of any previous site disturbances, and to obtain the names and locations of local artifact collectors who may have collected from the boulder monument site. Collections were reported from five sites; however, the one collection observed (the other four had been dispersed) was not organized by site, nor could the collector positively identify different sites' materials. Collections were made from three other sites during the 1980 research; however, the sparse recoveries did not significantly contribute to site analysis.

Five sites showed evidence of previous scientific excavation; however, written reports exist for only three of those researches, Montgomery (1908), Kehoe (1954), and Kehoe and Kehoe (1979). Of the remaining unexcavated sites three have been completely eradicated, one altered so drastically as to be virtually destroyed, and three others moved to a park site north of Regina (though one of the three was relocated due to local condemnation of the monument's removal). Eight other sites have been disturbed to some extent, although a sufficeint amount of the original structures remain to identify properly the features depicted. Thirteen monuments remain in relatively pristine conditions. The majority of these were protected by interested landowners who have consciously guarded these fragile resources, although four of the eleven may owe their existence to being regarded as large tipi rings.

Lichenometric measurements were taken at all sites where undisturbed boulders could be located. Lichenometry, as a relative dating tool (see Chapter II), was attempted with varing amounts of success. The application of this empirical form of dating was decided upon, as its field application would permit sampling without disturbance of any of the sites. Additionally, only two of the sites that have been excavated have reported dates (cf. Calder 1977, Kehoe and Kehoe 1979); and the funding and time available for this thesis's field research did not provide for excavation at all 30 Saskatchewan sites.

Native plant species were keyed out at all sites as information for comparisons between site classes or site subclasses, in the event that concentrations of certain species of plant may denote seasonality (if plant resources formed a portion of the ceremonies). However, no concentrations of plant species were noted at any of the sites.

The local site topography, natural resources, and distance and direction from other boulder monuments were observed for inter-site comparisons. In most instances only the site locations on similar topographical features and natural resources were common among the sites.

The availability of local rock types was noted for probable construction methodology or possible rock type preferences. Most sites displayed an average boulder size utilization and probable clearing away of all other surface rock in the portrayal of the pertinent boulder monument.

Boulder weights and numbers of boulders used to construct monuments were not measured or counted, as it was assumed that the particular features would be added on to by the builder(s) until an appropriate configuration was achieved. Boulder colours were noted to ascertain whether there was an attempt to construct an aesthetic feature. The occurrence of the limestone/dolomites varied from a single boulder at one site, to nine of these boulders at another site. Feldspathic metamorphic rocks were slightly more common; however, the granites and quartzites were the predominant boulder variety observed. One site (see 5.11.3, page 151) possessed only quartzite boulders in the monument; while the 45 tipi rings, on the same site, were devoid of any quartzite boulders.

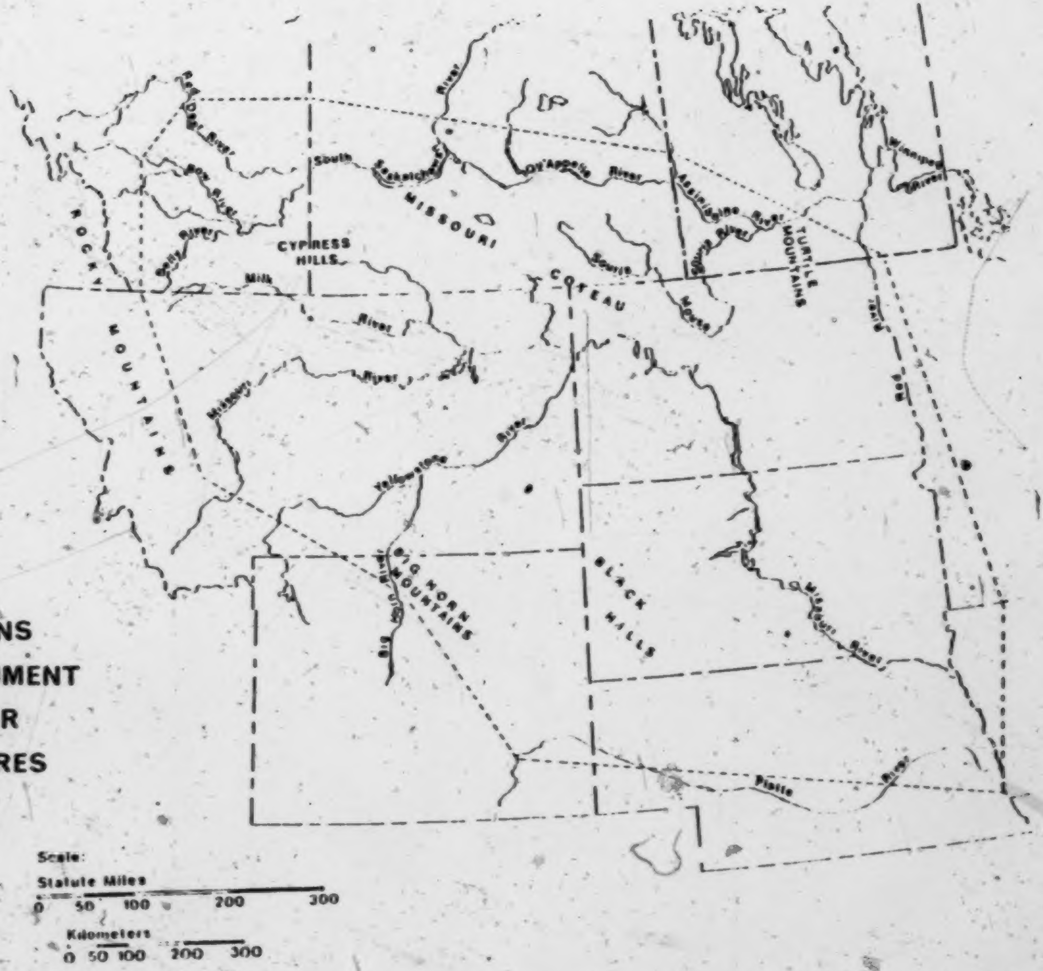
Extensive correspondence was conducted to obtain the exact feature locations in both Canada and the United States. It was assumed that distributions might reveal possible migration routes and type concentrations. The Canadian site locations were plotted on NTS 1:50,000 maps. American site locations were plotted on United States Department of the Interior 1:1,000,000 maps. In some cases, neither Canadian nor American legal locations were available. Consequently, some site locations were plotted by county, or near the town or landmark after which they had been named. These approximations should not pose any problems as the symbols used were large, obliterating any precise locations. As boulder monuments are protected cultural resources, none of the exact locations were reprinted within this text (at the request of all registering agencies).

This thesis used a field research cut-off date of June 1984. Since that time an additional four American and seven Canadian sites consisting of four medicine wheels, four ceremonial circles, two geometric, and one human effigy site have been recorded. This thesis utilized only data recorded prior to that time. Consequently, the boulder monument research revealed only the presence of 84 Canadian and 64 American site locations in the study area.

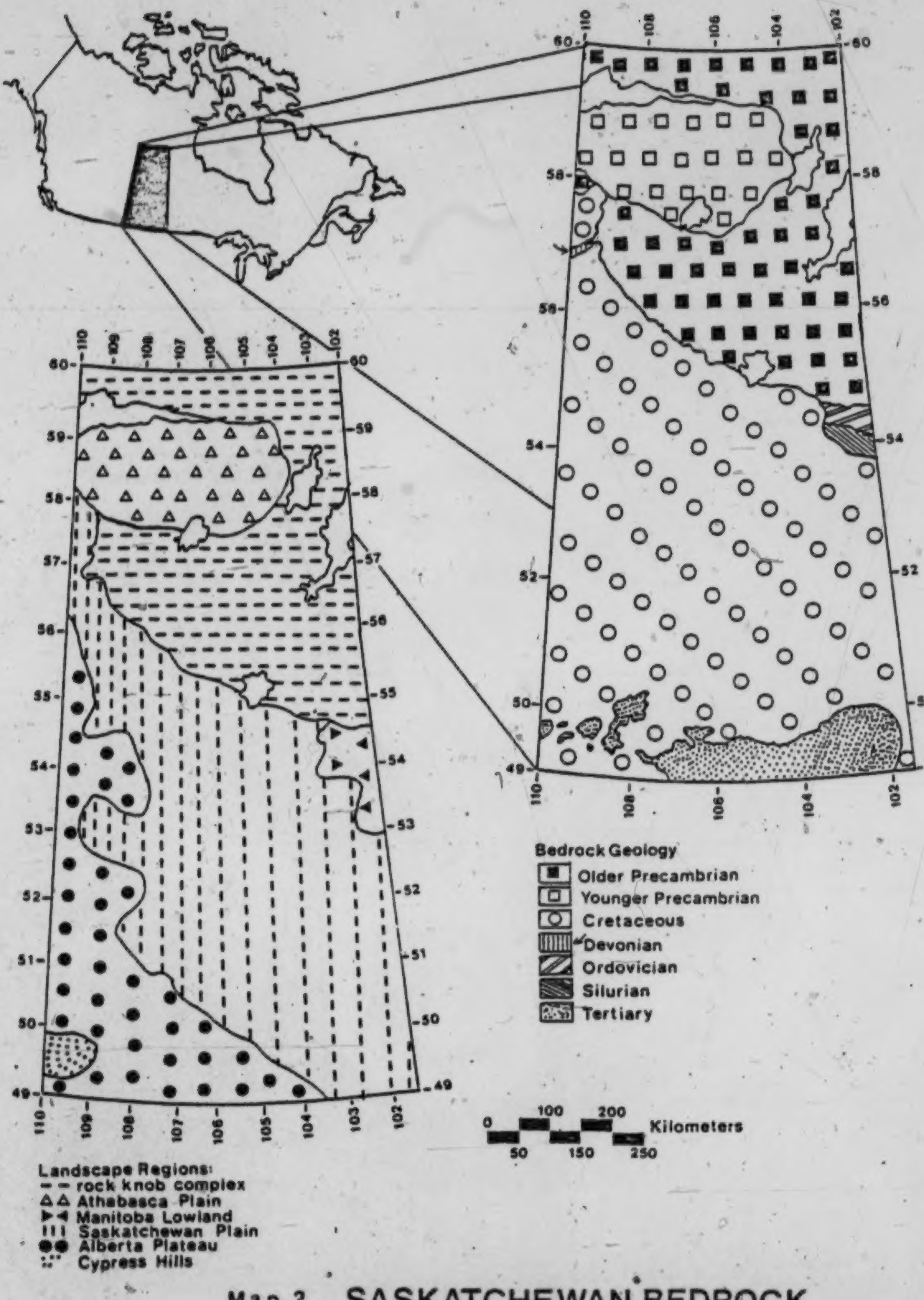
1.6 Study Area

The study area consists of the northern plains area where boulder monuments have been identified. In this study the northern plains area is bordered on the north by the North Saskatchewan River, by the foothills of the Rocky Mountains on the west, by the Platte River to the south. and by the mixed aspen forest on the east and northeast. In Canada this area includes southern portions of Alberta, Saskatchewan, and Manitoba; and in the United States, the eastern two-thirds of Montana, the central-eastern portion of Wyoming, the northern half of Nebraska, the northwest corner of Iowa, the western third of Minnesota, and the whole of North Dakota and South Dakota (Map 1).

The major Saskatchewan bedrock formations are the Cretaceous and Tertiary silts and clays. These are overlain by glacial sands and gravels which were subsequently intermixed with fluvial and alluvial silts and clays (Map 2). The Northerwestern Great Plains area is cross-trenched by two major and one minor drainage systems and their tributaries (Map 1). The rivers cut through the underlying sediment and bedrock, transporting a great variety of rock materials, some of which were utilized by prehistoric itinerants for tool manufacture. The major drainage systems are the South Saskatchewan and Missouri River systems, while the Assiniboine River and its tributaries constitute the minor source. Numerous uplands, some timbered, are observed. Among these uplands are the Missouri Coteau in Saskatchewan and North Dakota (Coteau du Missouri, in the latter), the Black Hills of South Dakota and Wyoming, the Moose Mountains of Saskatchewan, the Cypress Hills of Saskatchewan and Alberta, the Sweetgrass Hills of Alberta and Montana, and the Turtle Mountains of Manitoab and North Dakota. Other minor uplands, too numerous to cite, are evidenced in each of the political areas listed for the Great Plains area. These uplands are interspaced among plains-plateau regions, characterized by level to gently rolling (0 to 40 percent) knob and kettle topography. The predominant soils are black, dark brown, and brown chernozems with scattered solonetzic and regosolic soils. The black chernozems tend to be sandy loams and the dark brown chernozems a loamy clay, while the brown chernozems are either heavily clayed or a mixed clayey loam. Solonetzic soils are characteristically


Red Deer River
Bow River
Belly River
ROCKY MOUNTAINS
Milk River
CYPRESS HILLS
South Saskatchewan River
MISSOURI COTEAU
Qu'Appelle River
Assiniboine River
Souris River
Souris
Mouse
TURTLE MOUNTAINS
Winnipeg River
Red River
Missouri River
Yellowstone River
BIG HORN MOUNTAINS
Big Horn River
BLACK HILLS
Missouri River
Platte River
Scale:
Statute Miles
0 50 100 200 300
Kilometers
0 50 100 200 300

Map 1
NORTHERN GREAT PLAINS
area of BOULDER MONUMENT
OCCURRENCE and MAJOR
PHYSIOGRAPHIC FEATURES


Landscape Regions:
– – rock knob complex
△△ Athabasca Plain
▶◀ Manitoba Lowland
❘❘❘ Saskatchewan Plain
●● Alberta Plateau
⁚⁚ Cypress Hills
Bedrock Geology
Older Precambrian
Younger Precambrian
Cretaceous
Devonian
Ordovician
Silurian
Tertiary
0
50
100
150
200
250
Kilometers
110
109
108
107
106
105
104
103
102
60
59
58
57
56
55
54
53
52
51
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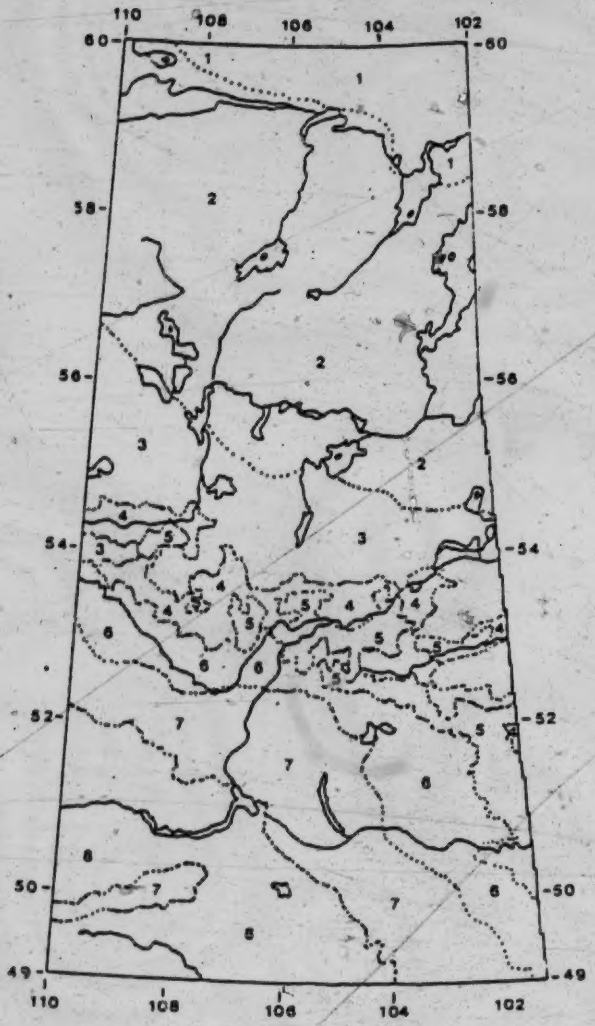
49

Map 2 SASKATCHEWAN BEDROCK GEOLOGY & SURFACE LANDSCAPE (adapted after Richards and Fung 1969:40, 46) saline, whereas regosols are weakly developed parent material soils (cf. Hedlin 1978).

This area is characterized by a continental climate with dominant northwesterly winter winds and predominant southeasterly summer air masses. The average annual precipitation varies from approximately 38 centimeters in the central plains to approximately 70 centimeters along the eastern margins. The majority of precipitation occurs during the frost-free summer growing season, with the remaining 30 to 35 percent falling as rain or snow during the other three seasons (Map 3).

The southern boundary of this area is typically tall grass plains, with a gradual northwestern transition to short grass plains, corresponding with an increased east to west aridity. The major transecting rivers and most of the minor ravines and coulees support cottonwoods (Populus deltoides) and native shrubs and vegetable foods such as choke-cherry (Prunus virginians), saskatoon (Amelanchier alnifolia), dewberry (Rubus pubescens), wild gooseberry (Ribes oxyancanthoides), wild onions (Allium spp.), and other herbs and forbs (see Angier, 1972). The dominant native plains grasses are spear grass (Stipa comata), wheatgreas (Agropyron dasystachyum), fescue (Festuca scabrella), blue grama (Boutelova gracilis), and June grass (Koeleria cristata) (Budd and Best 1964). The eastern boundary graduates into hardwood forests, whereas the western foothills and eroded buttes have ground juniper (Juniperus scopulorum) and a gradual increase to softwood forests. The northern boundary's short grass prairie graduates into a mixed aspen forest (Populus tremuloides), and ultimately into a jack-pine (Pinus banksiana) and black spruce (Picea mariana) forest.

The European fur trade and settlement, over the past three centuries,


110
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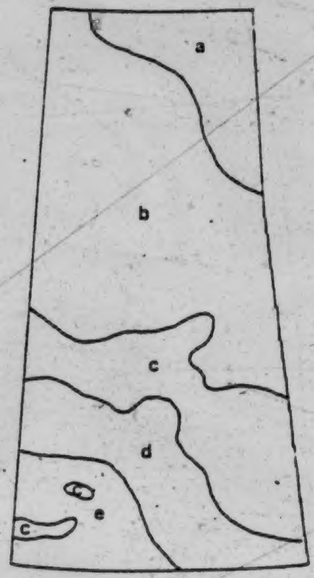
SOIL ZONES:

1 - forest-tundra, podzolic & organic; rock outcrops
2 - podzolic & organic; rock outcrops
3 - podzolic & organic
4 - gray wooded podzolic
5 - transitional (black-grey) organic & meadow
6 - black
7 - dark brown
8 - brown

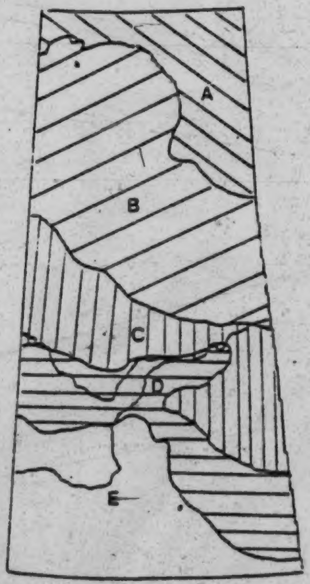
Map 3
SASKATCHEWAN SOILS, VEGETATION and CLIMATE

(adapted after Richards and Fung 1969:4)



CLIMATIC REGIONS:

a - arctic transition
b - sub-arctic
c - humid continental
d - sub-humid continental
e - semi-arid



VEGETATION AREAS:

A - forest-tundra transition
B - coniferous forest
C - mixed forest
D - aspen parkland
E - mixed prairie

has resulted in the extinction of the buffalo wolf (Canis lupus nubulius), the kit fox (Vulpeo velov hebes), the passenger pigeon (Ectopistes migrotorius), and the Eskimo curlew (Numenius borealis). Additionally bison (Bison bison), grizzly (Ursus horribilis americanus), elk (Cervus canadensis), and mountain lion (Felis concolor) have been extirpated in all areas save marginal and divergent habitat (Maher 1969: 84, Braithwaite 1975:102-103). Agriculture and urban development, in conjunction with extirpation, have induced other wildlife species to adapt to the new, forced, environments (cf. Richards and Fung 1969:80-81).

1.7 Human Occupation

Archaeological surface recoveries and excavated sites indicate human occupation of the Northern Great Plains throughout the past 12,000 years (Dyck 1983:65-68; Frison 1978). Who these initial inhabitants were, where they emigrated from, and how they integrated with one another are problems yet to be solved. The variety of projectile point forms, and introduced changes in tool and weapon technology (cf. Dyck 1983:65-68) suggest continual introductions of peoples and cultures through time. Two hundred years ago Edward Umfreville noted eight major tribes occupying the Northern Plains (Umfreville 1954:91-92). Similarly fifteen major tribes were noted for the American portion of this area (Spencer and Jennings 1965:339; Malouf 1967:15; Ewers 1979:Plate 1).

1.8 Summary

This chapter presents an introduction to boulder monuments, denoting their spatial range, previously defined characteristics, construction features, and present propositions for comparisons. The classes advanced were designed to lead toward defining who the monument builders were. The methodology of site recordings is suggested for better future cross comparisons with other area occurrences. The brief review of the nature and ecology of the Northern Great Plains was presented to give the reader an insight to the landscape which was utilized by a variety of human occupants.

CHAPTER II

DATING

2.1 Introduction

During my 1980 examinations of boulder monuments, I realized that few of these sites had been dated. Additionally, I was faced with the dilemma of how to attempt to date the Saskatchewan boulder monument sites without conducting extensive excavations. Neither the funds nor the time available were sufficient to hire extra personnel to complete this research at the Saskatchewan sites.

By 1980, only the three medicine wheel sites, at Moose Mountain in Saskatchewan, Majorville Cairn in Alberta, and Big Horn in Wyoming had been dated by either radiocarbon or dendrochronology means. No dates existed for the large circle, human and animal effigies, or for geometric configurations. At present (1986) some medicine wheel sites in Alberta have been dated by projectile point associations; however, no dates yet exist for the other boulder monument types (B. Byrne, personal communication).

In conjunction with the lack of dated boulder monument sites, is the usual lack of datable materials available at many of those sites. For example, I assisted with the excavation of a medicine wheel in 1972 on the Suffield Military Base. The entire outline was excavated, yielding a single undiagnostic lithic flake and no radiocarbon-datable material. Similarily, Gil Watson and Tom Kehoe, who mapped most of the Saskatchewan boulder monument sites, both reported that they had not located any diagnostic projectiles which they could use for relative dating. Additionally, most of the artifacts that were recovered originated from rodent burrow back-dirt piles, possibly evidencing earlier tradition occupations of individual sites. These dating problems can be examined best by reviewing the available information on boulder monuments, both in Saskatchewan and at other northern Great Plains sites.

Montgomery's 1907 excavation of a mound in the Halbrite district of Saskatchewan represents the first recorded excavation of a boulder monument on the Northern Great Plains. His excavations were an attempt to categorize the western mounds in terms of those encountered in the Mississippi valley. The possibility of contemporaneity was suggested on the basis of the discovered human skeletons which prompted a decision that the mound builders preceded "Siouan movements to the plains region" (Montgomery 1908:39-40).

While other boulder monuments have been excavated in Saskatchewan, Manitoba, and Alberta (cf. Wormington and Forbis 1965, Calder 1977, Kehoe and Kehoe 1979, Carmichael 1979), only Calder and the Kehoes have published dates derived from radiocarbon analysis of excavated materials. Other sites have been excavated but only a few ages of construction dates, estimated by means of radiocarbon dating or projectile point association, have been published (to date [1986] of research termination: T. F. Kehoe, B. Byrne, personal communications).

Calder, who excavated the Majorville Cairn, reports a radiocarbon date of 3845 ± 160 B.P. (1895 B.C.) from bone samples and an obsidian hydration date from central cairn samples (1977:42, 22 Figure 6). At Moose Mountain, the Kehoes' 2650 ± 245 B.P. (440 B.C.) radiocarbon date was from small fragments of charcoal at the base of the 1.06 m cairn "16 cm below the rocks" (Kehoe and Kehoe 1979:42). While Calder does not specify the bone species utilized for carbon dating, his faunal analysis for Layer 14 (sample layer) includes only rodent, Richardson's ground squirrel, and undetermined bone materials (1977:197-199, Table 27). He admits that:

> An estimated minimum of 50 Richardson ground squirrels were represented in the faunal remains ... (and) ... rodent activity and burrows were noted in all layers, with a significant increase in such activities in Layer 14 and lower layers. Similar activity was also intensive beneath the cairn (Calder 1977:29).

Similarly, the Kehoes note discovering pencils that gophers and rodents had stolen during their 1961 mapping of the medicine wheel. These rodents had deposited the pencil remnants, "gnawed at sweat-stained areas," among the upper rocks (Kehoe and Kehoe 1979:54). Consequently Calder's bone and the Kehoe's charcoal samples may represent rodents' removal of debris from underground burrows, particularly if the remains represented earlier deceased rodent remains or a possible burned "shrub taproot" (Kehoe and Kehoe 1979:42). Personal observations noted while conducting field surveys for SMNH showed that the back-dirt at rodent den openings possessed cultural objects revealing underground features, the skeletons of former den inhabitants, and/or the scats removed from the burrow. The observation of these back-dirt piles served as possible site indicators on both cultivated and uncultivated land where surface artifacts were lacking or scarce. Therefore, the published radiocarbon dates may be inaccurate time estimates for the time of central cairn constructions because of possible rodent disturbances.

Similarily, the use of projectile points as a dating mechanism is problematic at a boulder monument site. The use of projectiles dated at stratified sites may have little or no bearing on site age at surface sites without stratigraphy. Certainly, early projectiles may evidence the origin era of a boulder monument; or, alternatively, they might represent numerous individual's offerings to the monument of artifacts found elsewhere.

2.2 Lichenology Background

As the scope of this research was to examine all types of boulder monuments, a method of dating applicable to monuments without cairns, and therefore possible datable contents, had to be devised. Benedict's (1967) paper describing the application of lichenometry to rock structure dating suggested a method for dating Saskatchewan's boulder monuments. As the application of lichenometry had worked well to date prehistoric rock walls in Colorado, I decided to apply lichenometry to prairie boulder monuments in an attempt at discovering a viable dating method for surface stone deposits. In other locations lichenometry has been used to date buildings (Follman 1961, in Webber and Andrews 1973:295). Also Andrews and Webber (1969) found lichenometric dating valuable in tundra areas where historic records and radiocarbon materials were unavailable.

Lichens are composed of microscopic green or blue-green algae in symbiosis with colourless fungal mycelia. This symbiosis results in the formation of a thallus ~~or plant~~ body. Lichens occur in three forms: crustose lichens forming spreading encrustations, foliose lichens showing horizontal leafy or ruffled expansions, and fruiticose lichens which are upright stalked or strap-shaped fronds (Bland 1971:1314).

Roland Beschel developed the technique of using lichens to date morainic debris in 1950. He assumed that the lichen thallus of greatest diameter indicated the age of surface exposure (Beschel 1961). His preference for crustose lichens, notably Rhizocarpon geographicum, was based on its "constant growth rate of 1.0 m over centuries" (Hale 1974:78).

Climatic environment, notably moisture and light, are the primary factors influencing growth rates:

> Lichens are capable of assimilating and growing only when in a thoroughly saturated condition ... they spend the greater part of their life either in a state of xeric rest or else in a cold influenced torpor. Snowmelt, dew, and above all, rain provide lichens with the possibility of growth, assuming that there is simultaneously a sufficient supply of light (Beschel 1973:303).

To date the retreat of glaciers, Beschel (1950, 1961) used lichen growth rates established for graveyard headstones. When the date of the growth surface is known:

> ... it is possible to plot the size of the thallus against its calculated age, and so determine the rate of growth (Richardson 1975:45).

Beschel's basic premise maintains that lateral and terminal moraine furthest from the snout of a retreating glacier are older than moraines near the snout. This can be ascertained by identifying and measuring the radial sizes of crustose lichens. Crustose lichen size patterns, in addition to revealing glacial retreat, also will reveal glacial lobe retreat patterns (cf. Beschel 1973:304-306).

All boulder monuments examined in Saskatchewan possessed lichens on the upper boulder surfaces. Therefore, lichenometry was determined to be a potential dating method. The size of the largest thallus measured at these sites was assumed to be an indication of the amount of elapsed time since the boulder monument's construction - when compared against the largest thalli on a dated source within the same environment. Additionally, as lichens may grow more quickly on different rock types, the rock types were noted so that specific lichen species growing on specific rock types would be compared only with their similar entities at the selected historic sites. Because the cairns at some monument sites may have been formed over successive generations, the large thalli encountered on basal rocks may indicate total time elapsed only if the diameter of the cairn had not been substantially increased (covering a previous cairn periphery). Correspondingly, thalli measured from the top or upper edges of a cairn may indicate only the time since the last additions were made to the structure.

It was presumed that when constructing a boulder monument an attempt to illustrate the purpose could have been designed into the feature for other persons to realize that the structure represented a noteworthy event or revealed a specific message. If such was the case, it is speculated that boulder monuments could have been constructed with the original boulder bases (clear surfaces) facing upward to illustrate a new configuration rather than an accidental stone arrangement. Therefore, only those monuments of single boulder tier construction should possess unmodified lichens (colonized on the clear exposed surfaces) suitable for dating. Alternatively, if the lichen exposures were reoriented in excess of 45 to 55 degrees away from original declinations the lichens would die and be dislodged by erosion (Jon Luman, Swift Current Experimental Farm - personal communication 1980). In either event the newly formed monument might possess numerous boulders devoid of lichens soon after construction. Lichen recolonization and succeeding growth should be evident from average large thalli diameters. This diameter average, as opposed to the largest thalli diameter, should then suggest a measure of the length of time since monument construction.

2.3 Method

In order to identify the different lichen species suitable for the dating measurements, approximately 50 representative boulders encompassing all of the rock types were removed from a variety of sites. All boulders were cushion packaged to prevent thallus abrasion. Each boulder was later individually replaced in its respective monument.

The three lichens identified for dating measurements were a crustose, *Dimelaena oreina*; and two foliose umbilicates, *Rhizoplaca chrysoleuca* and *R. melanophthalma*. *D. oreina* was common at all of the Saskatchewan sites; however, the two umbilicates were presented better at one western provincial site. *D. oreina* is the most widespread species of the genus, and is notably abundant in the more arid regions of North America. It includes five chemotypes (chemistry models), of which chemotype V, the "sticticnorstictic acid variant", is the most common on the North American central plains (Sheard 1977:103-104; 1974:133). Specific *Dimelaena oreina* chracteristics are:

> ... its radiate-plicate thallus margin, one-septate brown spores with unthickened walls and ... its adnate lecanorine apothecia (Sheard 1977:103).

To obtain a representative sample from the site the three species identified were measured at each boulder monument site on single tier boulders on each side of the feature. Lichen identifications were performed by examining each boulder or headstone with a three power hand magnifying lens to determine the species and to define the lateral margins of the largest thalli. The magnifying lens was particularly useful when examining headstones, where some lichens were so small as to be nearly invisible to normal view. Also the magnifying lens was necessary to delineate *D. oreina* from *D. radiata*, *D. thysanota*, and *Lecanora stellato*, as all share similarly shaped marginal lobes (*cf.* Sheard 1974:137). When it was difficult to define marginal lobes, the apothecia (reproductive structure), centrally located in *D. oreina*, "very common with black disks" (Hale 1979:32), were first identified. When the species was determined, the marginal lobes were traced away from the centers with a fine-tipped red felt pen so that the margins could be recognized when being measured under higher magnification.

A seven-power hand lens with an interior recticle calibrated in tenths of a millimetre was used to measure lichen thalli. The maximum number of clearly definable lichen thalli available were measured at each site; however, only the largest thalli on each boulder was measured. In one case it was necessary to measure all three identified species to obtain a representative sample from all portions of the feature. A minimum representative sample was considered to be ten clearly definable thalli. All thalli measured occupied the upper centre of individual boulders: The desired sample consisted of one thalli measurement on individual boulders at each of the outermost cardinal directions, one measurement each at the inter-cardinal directions representing different site elevations from the outer measurements, and two near the centre of the boulder monument at a relatively common elevation. For medicine wheels, samples were measured at the outer ends of the spokes, along the spokes, and at the center of the feature. Because few thalli were perfectly circular, two measurements (one north to south, one east to west) were taken; and an average diameter was calculated. In some instances measurements were taken on thalli which were successfully impinging on other thalli, as it was presumed that the larger thallus would dominate and could be remeasured in the future for supportive observations. In some cases the _D. oriena_ sample for a single rock type was less than the ten samples presumed representative. In these instances the thalli on both quartzite and granite boulders were independently measured for later independent comparisons.

The double direction measurement and subsequent averaging of individual lichen thalli might be questioned. Webber and Andrews (1973:295) stated a concern against the averaging of lichen dimensions; however, it is assumed that their argument was against the averaging of many thalli to obtain a maximum growth size, rather than against the method employed in this research.

Lichens on datable farmers' rock piles within a three kilometre radius of a site were measured, as were those on local graveyard headstones (usually graveyards were located in excess of three kilometres distance from the boulder monument sites). Even when datable lichen thalli were available within a three kilometre radius, the separation of the monument and the datable site may introduce error in the age estimate because different environment regimen may exist at two sites. The thalli measurements on farmers' historic rock piles (where assurances were obtained against recent pile additions) were those at the pile apex and on surrounding upper boulders. Basal rocks were found to be devoid of lichens due to shading by grasses, shrubs, and forbs. The thalli measured on headstones were those colonizing the top of the headstone or those on the lateral surfaces (where no sample measurements were possible on the uppermost surface).

A headstone memorial distributor was consulted for information pertaining to quarry site locations and the term of headstone erection. Only those granite headstones quarried from Canadian Shield areas were measured, as it was assumed that these samples should possess similar chemical constituents to the surface, glacial-deposited granite boulders. These similar granites should produce similar lichen establishment and growth rates, alleviating possible abnormal lichen diameter observations (as between granites from many sources). As the lichens available for this dating technique do not grow on calcereous rocks, headstones and boulders composed of limestone, dolomite, marble, and cement were not examined.

Of the 14 most popular types of headstone materials available to memorial dealers, only five granite types (Canada Red, Britz Blue, Mountain Rose, Autumn Pink, and Red Diamond) are quarried from Canadian Shield locations (L. Wight, personal communication). Headstones are usually ordered and erected within two years of an individual's death. All headstones are erected at gravesites during the frost-free seasons so that the stones can be set solidly in their cement bases. Only headstones which had not been smooth cut on the top and lateral sides were suitable for lichen colonization (cf. Beschel 1973:303).

2.4 Problems and Concerns

With any new method there are problems, and lichenometry is no exception. Early in its application in geological research, there were objections to lichenometric techniques. Some individuals assumed that lichenometry should best be researched by botanists (cf. Jochimsen 1966). However, in my opinion, since anthropology is a broad-encompassing discipline, a lichenometric dating technique might be used if a benefit possibly can be derived.

Of primary concern are the different environments of boulder monument sites and the dated comparative sites. In most instances farmers' rock piles were the best control comparisons. Unfortunately, not all of these piles could be dated with absolute accuracy, as in cases when the rock pile had been constructed by a landowner who had retired elsewhere (and the present tenant was not aware of the date of construction), or when the person who could date the pile was deceased. In other cases rock piles had been added to, or early piles had been removed for landfills or road construction. The headstones utilized in the absence of datable rock piles were usually located in excess of five kilometres from the monument sites. In two instances a common comparative historic site was used, as it was the only available source for each of the two boulder sites.

A second major concern is the lack of lichen establishment rates or growth rates for Saskatchewan. Beschel stated that lichens colonize the crevices and hair cracks immediately upon the exposure of the rock surface:

> ... at first there is a considerable period before the young lichen thallus becomes even macroscopically visible ... then a relative acceleration of the growth rate occurs ... to a certain diameter (the great period) ... where upon the diameter abruptly begins to grow ... more slowly ... at a constant rate (Beschel 1950:1).

The "great period" (Beschel 1950:1, 1957:7-8) may last only a few decades, though Webber and Andrews (1973:289-299) have shown variability in this time at different geographical locations. Therefore, a 0.57 millimetre annual growth rate observed for D. oreina in Connecticut will have no bearing on sites on the Great Plains (Hale 1974:84).

Little is known of lichen succession or of competition between lichen forms on the Great Plains. Some thalli measured had lateral margins abutted against or over adjacent thalli of both similar and different species or type. Some D. oreina were being colonized by either Xanthoria sp. or Physcia sp.

Studies relating the absolute maximum life of D. oreina seem not to exist. Most present studies concerned with this species deal with pollution control (Hale 1952) or with species identification (Sheard 1974, 1977).

Most crustose and fruticose lichens are acid chemotypes. The basal chemical constituents of the organic bases (of whitewash for example) hygroscopically remove all moisture from the lichens, enabling erosional forces to disperse the dead tissues. Consequently, previous whitewashings of the boulders for aerial photography with quicklime (CaOH) killed and chemically removed all lichens from the boulders. This practise was curtailed at SMNH in 1979. Consequently, boulders are now dusted lightly with flour if aerial photography is required, as flour is not hygroscopic and washes off in rain or is readily dispersed by prairie winds.

Similarly, the Saskatchewan sites' lichens may have been affected by wind-borne alkalies during the great drought of the 1930s. Those alkalies, a form of calcium hydroxide (with a hygroscopic base), may have altered regional growth rates, as observed at the Percy Cemetery for the Moose Mountain comparative site (see Appendix I, DkMq-2).

Atmospheres polluted with sulphur dioxide (Brodo 1964; Ferry, Baddely and Hawkesworth 1973) or fluorine (Gilbert 1971) have been observed to kill lichens. The thalli at DhMn-9, located within 1.5 kilometers of a new oil well where the noxious odor of sulphur dioxide was evident in 1980, were discoloured and were flaking off the boulders (also see Hale 1974:84). The presence of viable lichen thalli on the boulders at DiMv-2, located directly beside a pumping well with an ignited gas vent, may show the lack of sulphur in the emissions.

Another possible agent of lichen disturbance is predation (or grazing) by animals. Lichens are utilized as a food source by mollusks, mites, and insects (Gerson and Seaward 1977:74); and by mice and bats

(Richardson and Young 1977:134-135). Some prairie birds utilize lichens in whole or as part of their nesting materials (Richardson and Young 1977:126-127). Ants (genus Hymenoptera) were observed to be removing both the crustose and umbilicate lichens from the comparative rock pile at Ef01-2.

At present, information does not exist concerning the effect of prairie fires on lichens. The destructive nature of the prairie fires noted by Hind (1971:336-337, 372, 405), in which even buffalo chips were consumed, also may have consumed the rock lichens. If the fires occurred on an annual basis the amounts of natural fuel (grasses, dung, etc.) may not have been sufficiently large to produce extreme ground heat. If the fires occurred less often, the increased amounts of fuel may have produced sufficient heat to kill the lichens.

Crustose lichens were observed to be intolerant of shade. Headstones observed to be shaded by surrounding trees, shrubs, forbs, or grass at cemetery sites did not bear lichens. Additionally, most cemeteries possessed some form of irrigation system. The increase in precipitation and relative humidity either by this unnatural condition or from early morning dews (most cemeteries were observed to be located in valley complexes where morning dew was a regular feature) should have provided more optimum lichen growth conditions. Headstones, as raised perches for both predator and prey species, were noted to possess numerous bird droppings. The increase in their dung, being primarily uric acid (Romer 1970:352), may have promoted lichen growth. For these reasons, the available dated farmers' rock piles were viewed as the best comparative sites, as the environmental conditions should have been relatively similar to those at the prehistoric sites.

2.5 Lichenometric Dating

The lichen growth rate studies are mainly concerned with measurements pertaining to the radial or areal growth of a thallus over a period of time. Woolhouse (1968) stated that the areal growth achieved by a thallus in a prescribed time interval was biologically significant as an interpretation of the interception of light. Armstrong's opinion states that:

> For the relative growth rate to be a valid measure of the growth of the whole thallus it has to be assumed that all carbon that is fixed by the thallus is potentially available for radial growth. This assumption presupposes that there is a translocation of fixed carbon from the centre to the edge of the thallus (Armstrong 1976:311).

Armstrong (1976) further illustrated that when using large thalli, the radial growth was comparatively constant, even if the centre of the thallus fragmented. This fragmentation suggests that the radial growth occurs independent of the thallus centre. Since radial growth is independent, thallus diameter averaging (two directional north-south and east-west) should produce a valid measurement of peripheral growth of the thallus through time.

At the best lichen dating will provide a relative surface-exposure age, though when the growth rates have been observed over a significant period of time, absolute ages may be delineated (Webber and Andrews 1973:295). The thallus diameter, as an estimate of surface-exposure age, is dependent on the radial growth rate (Armstrong 1976:314). The radial growth rate is dependent on the micro-climatic environment (Beschel 1957:11, 15). Therefore, without specific knowledge of regional climatology the best dates obtainable over a short period of time (less than 10 to 20 years) must be viewed only as relative. In this study thallus measurements observed in 1980 were equal to those for 1981.

2.6 Lichenometry Analysis

Following completion of measurements in 1980, the thallus diameters were arranged in tabular form with size observations ranging from the smallest to the largest. In almost all cases the observed sizes statistically defined a normal bell curve. Theoretically all lichen thalli pertaining to a single time of construction, when measured at all site surface coordinates, should fall within one standard deviation (or 68%) of the sample mean (cf. Thomas 1976:176-177). Larger thalli, therefore, represent the continual growth of colonies previously established, while the smaller thalli represent poorer microclimatic environments or possible surface inconsistencies to optimum growing conditions. The largest thallus within one standard deviation range at a prehistoric site was presumed to be the most viable common population, and was compared with the largest thallus meeting the same conditions of statistical analysis from the historic comparative base. The datable historic base's thallus size was translated into an assumed annual growth increment which was reapplied to the thallus size for probable number of years at the prehistoric sites.

The annual growth rate was achieved by dividing the thallus size in millimetres by the number of years since the construction of the historic comparison. The resultant numeral was an estimate of the annual growth historically. This estimated annual growth was divided into the millimetric size of the observed thallus size at the prehistoric site to yield an estimate of the number of years since that site's construction. Subtraction of the number of years from 1980 gave an estimate of the year of boulder monument construction.

2.7 Comparative Analysis Results

With the exception of one date, all estimations were derived from the analysis of the lichen Dimelaena oreina. The estimates are presented by Borden designation order in Table 1. Of the 18 sites where lichenometry was possible, four dates were analyzed based on a quartzite exposure, seven on granite, and seven from both quartzite and granite exposure. With the exception of EcNh-1, all comparative surface-exposure dates fall within six years of one another. Of particular interest are the two close dates achieved at ElOd-2, as both were derived from two different lichen species.

Acceptable data confidence levels range from high to questionable, based on the difference in elevation and/or the distance of the comparative dated site(s) from the individual prehistoric sites. The dates which were considered highly acceptable were those where the comparative site was within five kilometres distance and within 35 metres elevation of the prehistoric site. Fairly acceptable dates from comparative-sites were those within five to ten kilometres distance of the prehistoric site, even though the elevation limitations were similar to those stated for the high confidence level sites. The poor confidence dates are those in which either the elevations or the distance between sites were more than moderately different. The extreme elevation differences observed between the prehistoric and comparative locations for the two other sites were so excessive that no confidence (due to probable environment disconformities) could be accepted.

The high to fair confidence dates occur within the period of A.D. 1822 to A.D. 1898. The nine dates achieved, in which cases two

TABLE 1

LICHENOMETRY DATES

(Dimelaena oreina)

Site Borden Number	Historic Site Comparative Date					Prehistoric Site Data**		Date Confidence Level
	Stratum Q	Stratum G	Type Date	Elevation Difference(m)	Distance (km)	Stratum & Dates Quartzite	Granite	
DgMn-3(1)	R	R	1926	+.5	1.0	1878	1881	High
DiMv-2		C	1906	0.0	5.6		1819	High
DjMr-1	R	C	1919	8.0	8.0	1885	1891	Fair
DkMq-2		C	1923	-137.0	9.6		1880	No
DgNc-1	R		1911	-14.0	.8	1851		High
DgNf-5	R	R	1926	0.0	.3	1890	1889	High
DgNg-2	R	R	1926	-15.0	.8	1861	1857	High
DgNh-3	R		1913	-34.0	4.8	1856		High
DiNf-1	R	R	1915	-30.0	.4	1830	1825	High
DkOe-2	R		1910	.5	.3	1858		High
DkOj-2	R	R	1913	+11.0	4.8	1867	1864	High
EaNh-7		C	1918	-205.0	8.2		1769	No
EcNh-1	R	R	1938	+38.0	1.6	1868	1826	Fair
EeNe-14		C	1919	-69.0	5.5		1846	Poor
EeNg-1		C	1935	+15.0	10.2		1857	Poor
EgNx-1		C	1918	-53	10.9		1834	Poor
EfOl-2	R	R	1935	-30.0	1.5	1894	1898	High
ElOd	R		1920	+1.8	.3	1851		High
*	R		1920	+1.8	.3	1851		High

Legend:
Q - Quartzite
G - Granite
R - Rock Pile Site
C - Cemetery Site
m - Metres
km - Kilometres
no - no confidence
* - This data based on Rhizoplaca menophthalama.
± - Historic site x metres above or below prehistoric site elevation.
** - See Appendix 1 for date calculations

(Note: undated sites, due to all boulders having been previously white-washed with quicklime, site destroyed, lack of comparative historic site, or lichens destroyed by enamel paint [DgNg-1]).

types of surface-exposures, two comparative bases, or two lichens were utilized, occur between A.D. 1825 to A.D. 1898. While the poor confidence dates also might be acceptable, further research will be necessary to determine rates of thallus growth by site location. Five of the poor to questionable confidence level dates were those where cemetery headstones were the only datable comparative source. It is assumed that the increased distances, elevation differences, and non-identical humidities at those sites are the major contributing factors which would yield abstract dating results.

The most acceptable dates are those which utilize farmers' rock piles for a comparative base. As such, the rock piles would be susceptible to environmental fluctuations (prairie fires and droughts) similar to those experienced at the prehistoric sites, whereas most country cemeteries are surrounded by cultivated fields (less chance of being burned over), and most are irrigated (removal of drought conditions).

2.8 Discussion

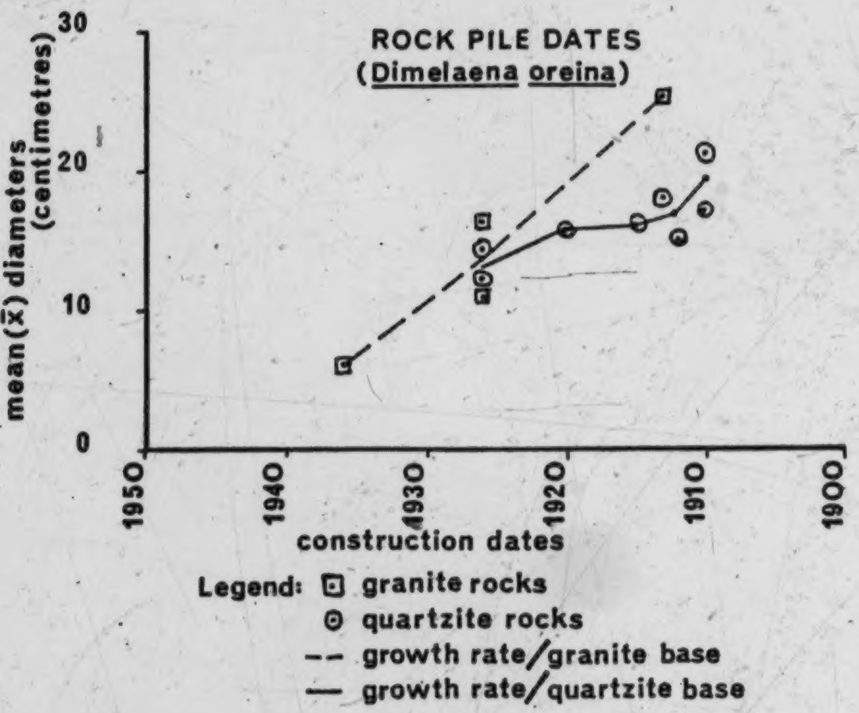
With the application of a new tool in a new area of endeavour, there is often a tendency toward complete acceptance of the results. In most of the other lichenometry studies examined in other geographical locations, the comparative historically dated objects displayed uniform thalli diameters (cf. Beschel 1957; Armstrong 1976). The Saskatchewan scene presents something of an enigma. Similarly dated headstones and rockpiles located regionally and across the province sometimes displayed radically different sized thalli diameters. Some of the reasons for these discrepancies have been discussed under the Problems and Concerns section. Some of the dates computed may be correct; however, the concentration of nineteenth century dates for the entire study area seems too compact for the multitude of boulder monument types encountered (see Chapter IV); unless the dates reflect the last era of activity associated with these sites.

To understand better the reasons for these discrepancies the rockpile and cemetery headstone dates observed were graphed (see Graphs 1 and 2, and Appendix I). Theoretically, if the two control bases produced similar thalli diameters, and therefore similar growth curves, the nineteenth century dates would be acceptable. Graph 1 illustrates the differences in thallus diameters and growth curves observed for _D. oreina_ on two rock types. One of the major problems with these control bases is the small comparative size sample (twelve mean diameters). The growth rate for lichens on granite rocks is based on four sites, with an averaged (or balanced) growth point intersection for two observed 1926 rockpiles. The growth curve for lichens on quartzite rocks, based on eight sites, was averaged toward the early end of the scale for the four close dates (1913 and 1912 estimated size at 1912.5 years, and an estimation for the two 1910 thalli size observations).

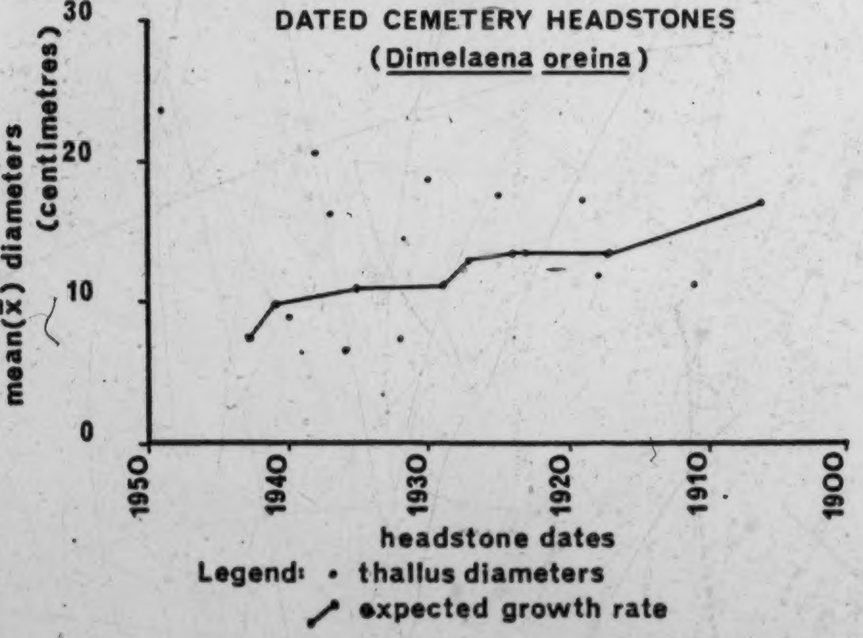
The thalli sizes observed for cemetery headstones (Graph 2), represent 20 cemeteries (mean thalli diameters). The alignment across the graph centre represents the expected growth curve based on the median of observed lichen diameters through time, as after the young lichen becomes visible:

> ... a relative acceleration of the growth rate occurs, which continues up to a certain diameter - whereupon the diameter abruptly begins to grow very much more slowly, yet at a constant rate.... it ends within a few decades. The constant continued increase in diameter ... lasts for many centuries in the case of many crustose lichens .... an absolute limit has not been

Graph 1



Graph 2



set for this increase (Beschel 1973:303).

In reference to the problems and concerns cited, all mean diameters above the curve alignment in Graph 2 may indicate well-cared-for cemeteries (irrigated, trimmed, and protected). For those mean diameters below the alignment it may indicate the reverse situation, insect-animal depredation or inferior micro-climates.

A remeasurement was conducted on all lichen thalli at the comparative historic sites in 1981, with no observable increase in thalli diameters. Consequently, continued remeasurements are planned for 1985 and 1990 so that increases may be noted during 5-year intervals. The present lack of other Great Plains comparative lichen studies leaves this research conjectural.

Regardless of the differences, the dated surfaces did not provide a stable comparative base. While I have confidence in the technique, and calculations, and the theoretical applicability of lichenometry, I believe that a larger comparative sample from numerous other sites around each boulder monument site must be sampled to establish better dating controls.

Additional research in this field of study, especially pertaining to the effects of fire on lichens, is required for confidence statements of lichen survival for continued growth and dating purposes. At present little is known concerning lichen establishment rates on granite headstones or on fieldstones. Dimelaena oreina was evident only on Canadian Shield headstones dated before 1950. The present use of this biological phenomena may be unsuitable to date cultural or prehistoric events in a plains environment, particularly events dating before the cessation of major annual prairie fires. Until more conclusive studies are published dealing with regional fire studies, precipitation measurements, or a larger lichen sample size with control dates, lichen thalli may be useful only to determine recent historic from prehistoric boulder configurations.

2.9 Summary

Lichenometric dating, utilizing the largest observed thalli, was developed by Beschel (1950, 1957). Since its acceptance as a dating tool it has been applied to dating historical and archaeological sites where neither written records or datable materials are evident. The presence of lichens on boulders at prehistoric Saskatchewan sites presented an opportunity to test Beschel's methods toward the development of a viable dating tool for this Great Plains area. The problems and concerns seem to outweigh the probabilities of a successful application of lichenometry to the plains situation.

CHAPTER III

ETHNOHISTORY

> ... the ethnohistorian has two main tasks: (1) the critical editing and presentation of historical documents relating to Indian cultures and (2) the interpretation of data gleaned from these sources (Wedel and Demaillie 1980:118).

3.1 Introduction

In an attempt to learn who the possible original boulder monument constructors were, it is necessary to review which tribes were residing on the Northwestern Great Plains at first white contact (ca. 1690) and during the 600 years prior to that time. This review is intended as an examination not only of the residents and their probable origins, but also to examine tribal migrations on and across the study area.

Thirty tribes representing ten language families possibly occupied the North American Great Plains over the past 700 years (cf. Spencer, Jennings, et al. 1965; Ewers 1979; Malouf 1967). Fifteen tribes, representing six language groups, are directly connected with the northern Great Plains area (cf. Wissler 1927:140-141; Skeels 1967:23) of Map 1. It is feasible that many other tribes representing other language groups explored, or at least traversed, this northern area. The ethnic identities of the total entourage of Great Plains occupants may never be known.

As the boulder monuments being examined are surface configurations, it has been assumed that these features were constructed by protohistoric tribes. Consequently, the earlier paleo- and meso- Indian periods are not discussed; save for the acknowledgement that the archaeological record evidences continuous occupation over the past 12,000 years (cf. Dyck 1983:63-140).

The earliest radiocarbon dates for plains boulder monuments both fall within the neo-Indian time (cf. Calder 1977, Kehoe and Kehoe 1976). Therefore, this time is assumed to represent the occurrence of the first boulder monuments.

The neo-Indian period in Saskatchewan is denoted by the introduction of two new forms of artifacts into the traditional bison hunters tool assemblage: clay pottery and side-notched arrowpoints. The pottery probably represents an eastern dispersal of population and technology, whereas the arrowpoints probably evolved on the western plains (after Dyck 1983:110).

The major complexes attributed to the neo-Indian period, 2000 B.P. to 170 B.P. (Dyck 1983:110), are Besant, Avonlea, and the Late Side-Notched Prairie and Plains Side-Notched technological series. Besant ceramic styles are known best from North Dakota and South Dakota and eastern Montana (Dyck 1983:115). Additionally, their emphasis toward Knife River Flint, also reflects the "hallmark of the Illinois Hopewell complex which thrust its far flung trading relationships and cultural influences into the Missouri River area between 2050 B.P. and 1750 B.P." (Willey 1966:273, 280). Several theories exist concerning the fate of the Besant complex. Some see it developing into Prairie side-notched forms, developing into the later Avonlea Complex, or developing into a seperate entity and displacing Avonlea. Byrne (1973:470) contends, that the selection of the most appropriate analysis requires future comparisons of all neo-Indian complexes.

Avonlea Complex sites seem concentrated in the southern portions of Alberta and Saskatchewan, and in northern Montana, with isolated sites in southern portions of Manitoba and northern Wyoming (Dyck 1983:123). Reeves (1983:164-166) regards Avonlea as a transformation of the earlier meso-Indian Pelican Lake Complex. Avonlea may have absorbed the earlier Besant complex and evolved into the later complexes, or they may have been displaced by these later complexes (cf. Dyck 1983:125). The final answer has yet to be resolved.

At present more is known about the Plains Villages of North Dakota and South Dakota than for any other late prehistoric Northern Plains group (Dyck 1983:126). When Prairie Side-notched complexes first appeared in Saskatchewan approximately 1100 years ago, Blackduck, a late Woodland complex, began to appear in southern Manitoba and northern Minnesota. Blackduck was characterized as utilizing Prairie Side-notched projectiles similar to those of the buffalo plains and larger Middle Woodland side-notched and corner-notched forms characteristic of the Great Lakes regions (Dyck 1983:126).

While the archaeology record substantiates continuous Plains occupations over the past ten to twelve thousand years, the natives encountered by early Europeans may be evidence of the most recent migrations into this area. Beginning approximately 1100 years ago the occurrence of the Blackduck ceramic phase in Manitoba denotes a culture intrusion, possibly of early Algonkians, from eastern woodlands (cf. Syms 1977). A population surge from the Middle Missouri agricultural peoples (Johnson 1969: 13), corresponding with a warmer and more moist climate (Bryson and Wendland 1967:294), may indicate the initiations of new western migrations. Following a two-hundred year drought, ending at 500 years B.P. (Lehmer 1971:128), there may also have been another surge of Algonkian and Siouan peoples westward from the eastern woodlands onto the Great Plains (Ewers 1968:173). While some ethno-archaeological studies, based on ceramic analysis (cf. Byrne 1973), or late-dated projectile point forms (cf.

Dickson 1977), are possible, the identification of all cultures by technological analysis may be questionable. Ethnological identifications of ceramics also rest on stylistic elements - not just technological characteristics.

Historical journals indicate great influxes of peoples on the northern Great Plains in the protohistoric and early historic periods (cf. James 1830; Cocking 1909; Hind 1971). Many historic and late prehistoric tribes laid tentative claims to portions of this area, (Lewis 1942; Malouf 1967; Mooney 1907), each with varying degrees of success. The following tribal entities are those whose claims or presence are recorded in many of the early records. Map 4 illustrates the presumed general tribal locations during the periods A.D. 1600 to 1690, 1690 to 1730, 1730 to 1840, and 1840 to 1870. These four periods define the assumed late prehistoric migrant areas, migrations initiated by the fur trade onto the prairies, the period of unrest caused by fur trade rivalry, and the latest migrations up to the era of the treaties with the Indians. As the tribes occupying this area are believed to have constantly engaged in inter- and intra-tribal warfare, all named areas delineate tentative locations. Additionally, these tribal migrations were probably small homogeneous ethnic groups, representing a band or autonomous kin group faction of a tribal unit (Syms 1982:2-3). The remaining tribe portions may have followed later, amalgamated with other tribes, or ultimately formed their own (in situ) separate, distinct, unit(s).

As earlier residents may have been displaced, or are not readily definable in ethnographic terms, this review of recent migrants onto the plains begins with the Algonkians. Their possible arrival 1100 years ago, as denoted by Blackduck ceramics and an assemblage comparable to both the plains and woodland projectile points, hallmarks tham as the possible earliest recent entrants onto the plains.

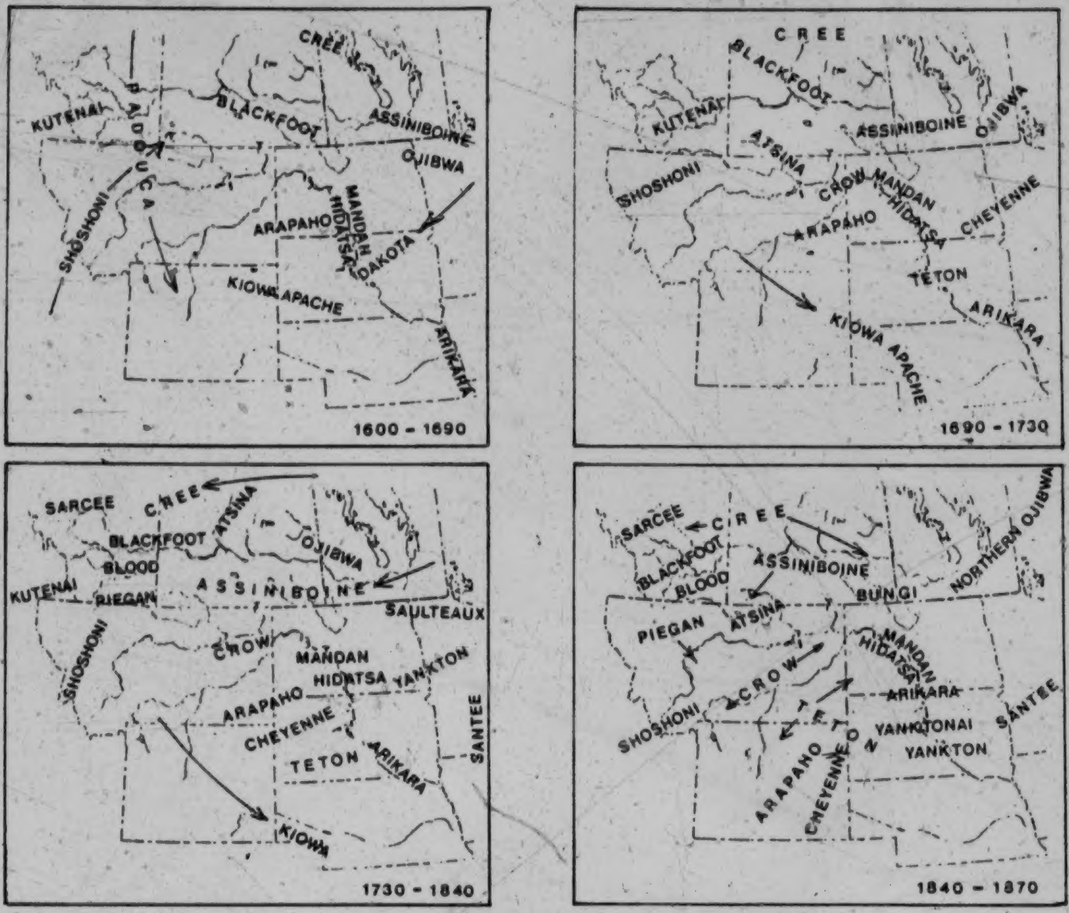
3.2 Algonkian Linguistic Stock

3.2.1 Blackfoot

The name "Blackfoot" includes the Blood (Kainai), Piegan (Pikunis), and the Blackfoot (Siksikas) (Longlance 1928:xiii; Schultz 1980:311). During historic times the Blackfoot occupied southern Alberta and northern Montana. The Piegan, the most numerous segment (Malouf 1967:8), occupied the Eagle Hills in Saskatchewan prior to 1730 (Lewis 1942:14-15; Thompson 1916:348). By approximately 1730 the Piegan had moved to southern Alberta (Wormington and Forbis 1965:238). In 1789 the Blood were located north of the Piegan, along the South Saskatchewan River; and the Blackfoot proper were reported north of the Blood (Lamb 1970:116). While "the previous location of the Blackfoot had not been established" (Lewis 1942:7), their linguistic affiliation as Algonkian assumes an ultimate eastern origin (Barbeau 1974:37). Their earlier territory probably extended from the North Saskatchewan to the Missouri River (Coues 1897 [2]:532-533; Barbeau 1974:37) and from the Rocky Mountains into sourtheastern Saskatchewan "... the eastern edge of the plains near the transitional region between the forests and plains ..." (Lewis 1942:15). The Saulteaux, at Crooked Lake in Saskatchewan, indicated that that area once belonged to the Blackfoot (Tarasoff 1980:8).

3.2.2 Cree

Prior to 1730 the Cree occupied the mixed forest area of Saskatchewan (Burpee 1927:25). Though they were armed with English muskets as early as 1690 (Mandelbaum 1979:21), they did not drive the Blackfoot out of the Eagle Hills in Saskatchewan until the 1730 to 1750 era.. The earlier


CREE
KUTENAI
PADOUCA
BLACKFOOT
ASSINIBOINE
OJIBWA
SHOSHONI
ARAPAHO
MANDAN
HIDATSA
DAKOTA
KIOWA APACHE
ARIKARA
1600 - 1690
CREE
BLACKFOOT
KUTENAI
ASSINIBOINE
OJIBWA
ATSINA
SHOSHONI
CROW
MANDAN
HIDATSA
CHEYENNE
ARAPAHO
TETON
ARIKARA
KIOWA APACHE
1690 - 1730
SARCEE
CREE
ATSINA
BLACKFOOT
BLOOD
OJIBWA
KUTENAI
PIEGAN
ASSINIBOINE
SAULTEAUX
SHOSHONI
CROW
MANDAN
HIDATSA
YANKTON
ARAPAHO
CHEYENNE
SANTEE
TETON
ARIKARA
KIOWA
1730 - 1840
SARCEE
CREE
BLACKFOOT
BLOOD
ASSINIBOINE
NORTHERN OJIBWA
BUNGI
PIEGAN
ATSINA
MANDAN
HIDATSA
CROW
ARIKARA
SHOSHONI
TETON
YANKTONAI
SANTEE
YANKTON
ARAPAHO
CHEYENNE
1840 - 1870

Map 4

NORTHERN GREAT PLAINS TRIBAL DISTRIBUTIONS

Distributions generally after Swanton 1952; Ewers 1955, 1979; Lewis 1942; Kerr 1966; Thomas and Ronnefeldt 1976. Additionally specific tribal distributions were noted from the maps or discussions for Shoshoni (Turney-High 1941), Padouca and Kiowa-Apache (Terrell 1975; Nye 1962), Cheyenne (Mooney 1907), Arapaho (Hilger 1952), Atsina (Cooper 1956), Crow (Denig 1953), Dakota (Howard 1966), Assiniboine (Kennedy 1961), Mandan-Hidatsa (Lowie 1976), Arikara (Lowie 1915), Cree (Mandelbaum 1979), Bungi-Ojibwa-Saulteaux (Grant 1960; Howard 1977), Blackfoot (Ewers 1973; Malouf 1967).

expulsion of the Blackfoot from eastern Saskatchewan probably began a few years after 1730, as:

> ... David Thompson ... tells of coming upon an old man of Cree origin among the Piegan, in the Foothills of the Rockies. When the Piegan was a very young man (Thompson estimates the date as about 1730) messengers came to the Cree asking them to join with the Piegan .... (Mandelbaum 1979:31).

Contact must have occurred between the Piegan and Cree at an earlier date for them to be aware of one another, and displacement of the Piegan (Blackfoot) by the Cree must have occurred later after an earlier alliance dissolved. That the Saulteaux knew their lands in eastern Saskatchewan had once belonged to the Blackfoot, may indicate both an early Blackfoot migration route and a Cree (Saulteaux allies) exploration route.

The Cree movement onto the Plains in western Canada was promoted by their desire for expansion, begun in 1670, and their resourcefulness as middlemen for the Hudson's Bay Company (Mandelbaum 1979:18-20). The Cree formed alliances with the Assiniboines about 1661 and with the Saulteaux about 1737 (Mandelbaum 1979:23-25). While minor differences possibly occurred after these dates, the combined force of these three tribes was sufficient to expel the Blackfoot from Saskatchewan by the 1820s.

3.2.3 Ojibwa

The Plains Ojibwa (Bungi) and Saulteaux (Northern Chippewa) were factions of the Minnesota Chippewa (Hickerson 1962:2; Howard 1977:5-6) who migrated out of Minnesota about 1740 (Hallowell 1936:34). As early as 1790 they were plying the fur trade along the Assiniboine River in western Manitoba and eastern Saskatchewan (James 1830:30, 37).

The Ojibwa-Cree alliance of 1737 was promoted by the former's desire to obtain firearms from the latter as a defense against their traditional Sioux enemies (Grant 1960:346). Following this alliance, the Ojibwa were noted to have attacked and defeated the Blackfoot both in Alberta and Montana (Skinner 1914:491-492).

3.2.4 Cheyenne

Prior to 1680 the Cheyenne may have occupied the forested area of central Canada (Mooney 1907:363). Weist (1977:11) indicates that the probable Cheyenne homeland may have been central-northern Ontario. Joliet's map of 1673 located the "Chaiena" above the mouth of the Wisconsin River, while La Salle records a group of "Chaa Indians" near Fort Crèvecoeur on the Illinois River in 1680 (Berthrong 1972:4). By 1684 the Cheyenne were located along the western Minnesota River, and by 1700 they had become sedentary farmers to the northwest of Traverse Lake in North Dakota (Berthrong 1972:5-6). By the late 1770s or early 1780s, war with the Chippewa forced the Cheyenne west to the Missouri River (Thompson 1916:261-263). As they had obtained horses from western and southern sources prior to 1750 (Berthrong 1972:9), their removal gave them "... free range from the Saskatchewan to the Rio Grande ..." (Mooney 1907:421).

By 1796 they were allied with the Arapaho in the Black Hills. When they left the Black Hills in the 1830s they divided into the Northern and Southern Cheyenne (Malouf 1967:10). The Northern Cheyenne maintained territory in South Dakota, northern Wyoming, and in southeastern Montana (Powell 1969:124). Besides the Arapaho, Berthrong notes that the Cheyenne allied themselves with the Sioux (1972:45); the Atsina and Blackfoot (1972:77); and eventually with the Kiowas, Comanches, and Kiowa-Apaches (1972:73). Their ability to traverse the entire Great

Plains is confirmed by their knowledge of 46 tribal names of "importance" (Mooney 1907:421).

3.2.5 Arapaho

The Arapaho were western neighbours of the Cheyenne on the Minnesota and Sheyenne Rivers (Berthrong 1972:17). Attacked by the Assiniboines and the Chippewa, as had been the Cheyenne (Swanton 1952:384-386), the Arapaho eventually allied themselves with the Cheyenne; and together they effectively drove the Kiowa and Kiowa-Apache out of the Black Hills (Berthrong 1972:17). As there was friction between the Teton Dakota and the Cheyenne (Berthrong 1972:19), the latter's alliance with the larger Arapaho tribe would have provided greater security against any foe. Since the Cheyenne were acting as middlemen between the Arapaho and the eastern Missouri Indians, the alliance would have assured the Arapaho of a continuous supply of goods.

Linguistically the Arapaho are closest to the Atsina, and both once may have been parts of a common tribe (Malouf 1963:13). This linguistic affiliation may have been the means for later unification among the Arapaho, Cheyenne, Atsina, and Blackfoot.

3.2.6 Atsina

The Atsina are also known as the Fall Indians, Rapid Indians, Gros Ventres of the Plains, and Gros Ventres of the Prairies. The latter two names distinguish them from the Hidatsa (Minnetari), who were known as the Gros Ventres of the Missouri (Swanton 1952:389; Kroeber 1908:146). Originally the Atsina were divided from the Arapaho by the Crow (Swanton 1952:385). The Arapaho moved to the southwest into southeastern Montana and South Dakota, while the Atsina were forced north into Saskatchewan (Swanton 1952:385) and into southern Manitoba (Lamb 1970:112). Where they entered Saskatchewan is unknown; however, their presence was known later near Prince Albert, as:

> ... the old South Branch House was destroyed by the Fall Indians in the summer of 1794 (Johnson 1967:253).

Their presence is noted along the South Saskatchewan River, as that river is recorded by Masson as "La Fourche de Gros Ventres" (Masson 1960 [1]: map). The same map indicates their Alberta presence, as the Belly River is referred to as "Rivière des Gros Ventres."

The term 'Gros Ventres' was assigned to the Atsina by French traders' adaptation of the sign by which the Atsina signified themselves:

> ... a gesture of the hand over the stomach indicating always hungry ... (Morton 1939:16).

Atsina is derived from the Blackfoot term "Atsena," meaning "Gut People" (Morton 1939:16; Kroeber 1908:145).

The Atsina allied themselves with the Blackfoot, probably when the latter resided in or near the Eagle Hills in Saskatchewan. About 1867 the Atsina allied themselves with their old Crow enemies in Montana, and were later heavily decimated during a conflict with the Piegan (Kroeber 1908:146).

3.3 Siouan Linguistic Stock

3.3.1 Dakota

Commonly known as Sioux, the Dakota are subdivided into seven bands:

> ... 1) Mdéwakàntaon (Spirit Lake People), 2) Wáhpekùte (Shooters Among the Leaves), 3) Sísitònwan (Sisseton), 4) Wáhpetònwan (Wahpeton), 5) Ihánktonwàn (Yankton), 6) Ihánktonwàna (Yanktonai), and 7) Títonwàn (Teton) (Howard 1966:3).

The first four are collectively known as the "Santee or Eastern Dakota" (Swanton 1952:282), whose dialect is "Dakota" (Howard 1966:4). Bands 5 and 6 are the "Middle Dakota", whose dialect is "Nakota" (Howard 1966: 3-4). Band 7 is the "Western Dakota", whose dialect is "Lakota" (Howard

1966:3-4).

The Dakota are first mentioned in the Jesuit Relations at or near Lake Nipigon or the Lake-of-the-Woods region (Swanton 1952:283, 388). These Dakota were not specified by either band or dialect, but may have been Middle or Western Dakota, as both these groups were noted in 1683 in northern Minnesota (Howard 1966:11, 20). Shortly after, both of these groups migrated toward the southwest. The Yankton moved into southeastern South Dakota, the Yanktonai settled to the north of them in southern North Dakota and eastern South Dakota, while the Western Dakota moved toward the Black Hills.

By 1700 to 1750 the Western Dakota, or Teton, migrated to the high plains along the Missouri River. Ultimately, their numbers increased until their band became larger than the other six Dakota bands combined (Howard 1966:20). As their population multiplied:

> ... the Tetons ranged southward into Nebraska, westward into Colorado and Wyoming, and northward into western North Dakota and Montana, with occasional forays into Manitoba and Saskatchewan (Howard 1966:21).

3.3.2 Assiniboine

The Assiniboine are referred to as Stonies or Stone Indians due to their method of cooking food with hot stones (Bryan 1968:289). They regard themselves as Nakota speakers. The Dakota refer to them as:

> Rebels, an appellation earned (by) joining the Plains Ojibwa and Plains Cree ... (Howard 1966:19).

Originally a part of the Yanktonai Dakota Hunkpatina sub-band, the Assiniboine separated from them when the Hunkpatina occupied the Lake-of-the-Woods district of Ontario (Swanton 1952:282, 388). By approximately 1661 they had allied themselves with the Cree, who were expanding northwest and west out of Ontario. The primary reason for the alliance was to obtain firearms and other trade goods which the Cree were receiving from British fur trade companies (Mandelbaum 1979:17-22).

Kennedy (1961:XXV) suggests that the Assiniboine movements after 1650 were toward northern Ontario and Manitoba, around the northern end of Lakes Winnipeg and Winnipegosis, and onto the Saskatchewan Plains (District of Assiniboine) by 1750. James (1830) suggests that Cree and Assiniboine movement was south of those two lakes, with arrival onto the Saskatchewan Plains at about the same time. Undoubtedly, both routes are feasible. The same route(s) was probably followed by the Assiniboine as recent Cree allies (cf. Swanton 1952:388).

By 1807, Alexander Henry could account for 11 Assiniboine bands in the Saskatchewan region (Rodnick 1937:410-411). Eventually, they spread to the Milk River districts in Alberta and Montana, and some to the northern Missouri River area in Montana (Swanton 1952:387).

During the 170 year period from A.D. 1690 to A.D. 1860, Assiniboine territory fluctuated. Their eastern exploitation border was reduced to the extreme southwestern corner of Manitoba, while their northwestern border shifted toward the Edmonton district, gradually decreasing to southwestern Saskatchewan (cf. Ray 1974:5-22). Between A.D. 1821 and A.D. 1860 the Assiniboine extended south into northeastern Montana and northwestern North Dakota (Ray 1974:96-101, 184).

3.3.3 Hidatsa

Also known as Minnetarees or Gros Ventre of the Missouri, the Hidatsa claim their original territory near Devil's Lake in North Dakota (Swanton 1952:276). They eventually migrated to the Missouri River area and allied with the Mandan, who introduced them to a horticultural mode of life (Bowers 1965:15). Originally composed of three sub-tribes, the

Awaxawi, the Awatixa, and the Hidatsa-proper, they eventually redivided into the Hidatsa-proper (commonly referred to as Hidatsa), the Crow, and the Mountain Crow (Bowers 1965:14-15). The Hidatsa extended their villages along the Knife River as well as maintaining villages among the Mandan (Wedel 1961:202-208). They may originally have lived in Canada or "... on the north side of the International boundary," prior to their settlement on the Heart River (Swanton 1952:573).

3.3.4 Mandan

La Vérendrye noted the Mandan villages along the Heart River (a tributary of the Missouri in North Dakota) in 1739 (Burpee 1927:335-337). Their oral history suggests a southeasterly migration from an eastern sea coast (Thomas and Ronnefeldt 1976:241). The Mandan maintained two villages on the Missouri River between the Heart and Little Missouri Rivers (Swanton 1952:276). The summer residence was near their gardens on the Heart River; the winter village was in a wooded area downstream from Fort Clark (Thomas and Ronnefeldt 1976:224). As sedentary, semi-agriculturalists, the Mandan enjoyed the advantages of their crops and the bison which frequented the Missouri River Valley (Thomas and Ronnefeldt 1976:174, 241).

3.3.5 Crow

The Crow, a former portion of the Hidatsa, separated from a sedentary, agricultural mode of life about 1776 (Denig 1953:17-19). Following this separation they further subdivided into the Mountain Crow occupying the Powder, Wind, and Big Horn Rivers of southern Montana and northern Wyoming, and the River Crow occupying the Yellowstone River from the Montana highlands to its confluence with the Missouri River (Lowie 1956:4; Swanton 1952:391). As instigators of the Atsina-Arapaho separation (Swanton 1952:386), the Crow may have pursued the Atsina north into Saskatchewan, thereby explaining the Atsina's displacement toward the geographical centre of Saskatchewan (cf. Johnson 1967).

3.4 Caddoan Linguistic Stock

3.4.1 Arikara

Sometime before 1714 the Arikara split off from the Skidi-Pawnee in southern Nebraska (Swanton 1952:274; Wedel 1961:162, 200). These semi-sedentary earthlodge dwellers ate fish and freshwater clams from the Missouri River. Also tool types found in their village remnants and middens suggest their utilization of a variety of plains birds and mammals (Wedel 1961:161-176). The majority of their villages existed from the Missouri River at its confluence with the Grand and Musselshell Rivers in North Dakota south to the central portion of South Dakota's Missouri drainage system (cf. Thomas and Ronnefeldt 1976).

3.5 Numic Linguistic Stock

3.5.1 Shoshoni (Shoshone)

The Plains Shoshoni were former residents of the southwestern Great Basin and intermontane areas of Utah and Nevada. Their northward migration may have been to search for more bountiful territories. The Wyoming Comanche separated from them during the migration; the remainder of the tribe continued north into Idaho and Montana, and possibly into Alberta and Saskatchewan (after Swanton 1952:403-404; Lowie 1909:169-173). Following their defeat by the Blackfoot the Shoshoni were expelled from the Canadian plains by the end of the eighteenth century (Malouf 1967:13). A variety of other plains tribes further harrassed them, eventually displacing them into the intermontane areas of Montana and Idaho (Lowie 1909: 171-173).

The Shoshoni were also known as the "Snake Indians" (Turney-High 1941:14). Previously this "Snake"-Shoshoni link has been used to qualify the Shoshoni in Thompson's 1730 reference to a Piegan-Cree alliance to "drive the Snake out of Blackfoot territory" (after Glover 1962:240-241). The term Snake also was an appellation used by both early chroniclers and other tribes to indicate a general reference to an enemy or to a different tribe (cf. Byrne 1973; Forbis 1963; McGee 1897).

Byrne (1973:515-538) contends that there never was a Shoshoni occupation of the Alberta plains, based on known ceramic analyses. However, the absence of definite Shoshoni ceramics from the known Alberta ceramic sites, recorded up to 1973, may not be sufficient evidence to renounce possible seasonal forays or sporadic occupations on the Alberta and Saskatchewan southern plains.

3.6 Kootenayan Linguistic Stock

3.6.1 Kootenay (Kutenai)

The Kutenai, a division of the Tunaha (or Tunaxa) (Swanton 1952:392), were located along the Belly River in southern Alberta (Lewis 1942:15). The Piegan also displaced the Kutenai along the Bow River during the mid-eighteenth century, and drove them back into their former intermontane homelands in Idaho and British Columbia (Lewis 1942:11).

3.7 Athabaskan Linguistic Stock

3.7.1 Sarcee (Sarsi)

The Sarcee were first mentioned by Cocking (1909:111) in 1772. Umfreville (1954:198) later located the Sarcee in 1790 near "Stoney Mountain." Alexander Henry (the younger) described their early nineteenth century location as:

> ... formerly on the north side of the Saskatchewan, but they removed to the south side, and now dwell commonly south of Beaver Hills near the Blackfoot with whom they are at peace (Coues 1897:531).

Also, Henry mentioned that the Sarsi "... have a smattering of the Cree language" (Coues 1897:532). This ability to communicate may indicate an earlier contact with the Cree, possibly occurring when the Cree first migrated onto the plains.

3.7.2 Apacheans

Sieur de La Salle first recorded Apacheans west of the Mississippi River in 1692 (Terrell 1975:13). Recorded as Gattackas and Padoucas, these bands were later identified as the Kiowa-Apache (Terrell 1975:18) and the Padouca Apache (Terrell 1975:14), respectively. Linguistically affiliated with Alaskan and Canadian Athapascans, the Apachean bands were estimated to have arrived on the northwestern plains between A.D. 1000 and A.D. 1500 (Basso 1971:12). At that time the Navajo shared a common language and culture with the Apache (Welsh et al. 1984:9). Additionally, the Gattackas were assumed to be closely related to the Sarsi (Terrell 1975:25-26). The Kiowa-Apache estimate their origin as:

> ... in the "hot-water country" along and north of the Yellowstone (river). About 1690, they began to drift eastward toward the Black Hills settling near Devil's Tower in Wyoming (Nye 1962:vii).

Separate migrations must have occurred as Athapascans also were noted along the Oregon coast and into northern California (Basso 1971:12). The Apache bands, however:

> ... moved southward from the immense Mackenzie River Basin, their route transecting the high open plains of Alberta, Saskatchewan, Montana, Wyoming, Nebraska, Colorado, Kansas, New Mexico, and the panhandles of Oklahoma and Texas ... in the end all of them moved on, seeping southward ... for no tribes speaking the Athapascan tongue settled permanently between northern Canada and Nebraska (Terrell 1975:13).

Some of the geographical areas cited by Terrell, above, may be questioned, as Hall (1944) states:

> ... the exact routes they travelled and the chronology of their migrations from the north have yet to be precisely determined (cited in Basso 1971:12).

3.8 Other Tribes

The Pend d'Oreille, Flathead, and Comanche tribes occupied various intermontane areas of the western portions of the northern Great Plains (Swanton 1952:239, 394, 386 - respectively). These tribes were not discussed, as their presence on the plains probably represented seasonal forays. Similarly, tribes bordering to the east, north, and south were omitted because of their intermittent use of the plains.

3.9 Discussions

The late prehistoric and early historic northern Great Plains occupants varied culturally and linguistically. The Blackfoot and the Arapaho were probably among the earliest Algonkian migrants on the Plains in protohistoric times.

> ... these groups are both Algonkian, but of speech highly diversified, as well from each other as from the great body of Algonkian ... Differention of such strength does not generally occur in languages that remain in geographical contiguity and intercommunication with the parent stock. It does often proceed with rapidity in languages that are subjected to contacts principally with alien idioms. If the Arapaho and Blackfoot drifted to the base of the ~~Rockies a~~ fairly long time ago, we should have them fulfilling all the geographical and historical conditions which in theory would be needed to account for their set-off linguistic status. Moving them into their recent habitat since the introduction of the horse, or even a century or so before, would not allow time for the existing degree of diversity, according to all authentic precedent on the rate of alteration of speech. We may therefore regard these two groups of tribes as ancient occupants of the northern true plains, or rather the foothills of the Rockies and the plains tributary thereto ... it cannot be asserted that the Blackfoot and Arapaho were the only ones formerly in the northern plains. They are the only ones we can be reasonably sure were there (Kroeber 1939:81-82).

The Algonkians were the most expansive in their migrations and exploits, ranging as far west as the Rocky Mountains and from Hudson Bay to the Rio Grande. The Siouan speakers tended to congregate centrally, toward the southern area. Single linguistic stocks were either repulsed early after their arrival; or, as in the case of the Sarcee and the Arikara, allied themselves with well-established area residents. The success or failure of most of the migrants was reflected in their ability to interact peacefully with the fur trade companies.

The Blackfoot had been acknowledged as "Archithine Indians" by Anthony Hendry in 1772 (Burpee 1907:316). The Cree designation of Blackfoot as "strangers" (Swanton 1952:395) may indicate an inability to communicate or an acknowledgement that the Blackfoot were simply not of their tribe.

The Apache, for example, are presumed to have begun their southward migrations "... as small bands of patrilocally-related kinsmen ... sometime around 1300 A.D." (Welsch, et al. 1984:9); and may have been cut off from a northern homeland by confrontations with Blackfoot plains residents. Thus, the Sarsi's Plains occupation may represent a mediation and ultimate confederation with the Blackfoot.

In comparison, the Cheyenne must have been later migrants, as the Cree term for these people was

> .... kanchiew estcik, Cree speakers, from the fact that the Cree could recognize some of the Cheyenne words (Mandelbaum 1979:9).

The Atsina, as former Arapaho tribesmen and precursor migrants of the Cheyenne, also must have been sufficiently early to effect an alliance with some Piegan bands, possibly through linguistic affiliation. The Blackfoot-Atsina alliance, in conjunction with the later Blackfoot-Arapaho-Cheyenne-Teton peaceful relationships, should have provided an avenue for intra-tribal exchange of physical goods and ceremonies toward the establishment of a Plains Indian identity.

As aggressors expanding their territories, the Cree undoubtedly avoided affiliation with Plains tribes. While they maintained alliances with the Assiniboine and Ojibwa, both the latter sought out the Cree. The Assiniboine were attracted by the firearms available to the Cree, while the Ojibwa were attracted by both firearms and a means of protection against the Dakota.

The Blackfoot, at Cree contact, were already under pressure, on the opposite flank, from horse-mounted Kutenai. This squeezing effect probably did not provide the Blackfoot with escape or avoidance routes. Their resistance against the Cree should have prompted the latter to regard the Blackfoot as hostile strangers (Franklin 1970:108), even if they are distantly related linguistically.

As the Crow had been the instigators in the Atsina-Arapaho separation, they may have been regarded as eternal enemies. As a Siouan group they would eventually be known to other Algonkian groups as antagonistic opponents. Crow access to horses, firearms, and ceremonies would have been achieved through raids on neighbouring tribes. Besides capturing the first two commodities, plains raiders also captured women, the vehicle for adoption of ceremonies, customs, and design and manufacturing motifs.

Short-term peaceful relations did exist between hostile tribes. Mandelbaum cites a Cree-Blackfoot truce (1979:41), a Cree-Mandan exchange of goods (1979:38), and a Cree-Dakota exchange of ceremony (1979:19-20). Additionally, the Dakota, Athabaskans, and Blackfoot all camped with the Cree at one time or another and often intermarried with Cree bands (Mandelbaum 1940:198). Any marginal commerce should have been sufficient to contribute to a ceremonial blending and certain outward appearances of a common plains identity.

The tribes occupying the various Great Plains sectors were seasonally adapted to their environment. The bison as "the Indian's larder" (George Arthur, personal communication) followed annual migration cycles in response to the environment. The Indian tribes and bands preyed upon these herds, and any erratic or unusual bison behavior could be compensated for as "... the hunters were conversant with their (bison) habits" (Allen 1876:61). In winter the tribes responded to bison ecology, sub-dividing into bands and sub-band units to utilize effectively the smaller cow and bull herds, fragmented after the fall rut. When the bison reformed larger herds in spring, the various Indian groups congregated to hunt them more effectively. This amassing of tribal populations permitted group ceremonies and the interchange of new ideas, new materials, and reallocations of individuals among family groups.

3.10 Summary

The major late occupants on the northern Great Plains were Algonkians from the eastern woodlands, migrating toward the west, northwest, and southwest. Siouan tribes penetrated toward the west-southwest from a separate eastern woodlands district. Other tribes entered from other sides but were either repulsed by Algonkians or Siouans, or were permitted areas regional to their entry locations. The one exception were the Apache who entered from the northwest and were driven south out of this plains area. In conclusion, Algonkians are seen to be predominant on the northwestern Great Plains, with Siouan tribes toward the centre and southern edge of this region.

CHAPTER IV

BOULDER MONUMENTS: A RE-EVALUATION

4.1 Introduction

Boulder monuments were first mentioned in what is now Saskatchewan in 1858 by Henry Y. Hind (1971:307). Other nineteenth century Saskatchewan observers were W. H. Clandening in 1863 (1928:246) and B. G. Hamilton in 1896 (unpublished diary, Glenbow Archives). The first excavation of one of these features in Saskatchewan was performed by Henry Montogmery in 1907 (Montgomery 1908). The Saskatchewan Museum of Natural History (SMNH) began recording boulder monument features in 1956, with the majority of the known sites being mapped between 1959 and 1975. Subsequent to that work, this research project mapped and recorded an additional eight features at five sites (including one feature which had been partially mapped). Of the total 33 Saskatchewan features, two were located by museum staff; while the remainder had been located and reported by archaeologically-interested residents.

The majority of the Saskatchewan boulder monuments are located on local heights or secondary heights of land; however, not every height of land possesses a boulder monument feature. All are located on land which was previously too stoney to cultivate. Some of the features which were destroyed recently owe their demise to more powerful, technically-advanced farm machinery. The majority of the sites are located in remote areas, away from travelled roads; an aid to their preservation.

As possible comparisons the pertinent landforms, degrees of unobstructed view, and the distance and direction to a permanent water source were observed for each site. With the exception of two sites (see 2.4.4 Ceremonial Circles: DgNg-2; 2.5.2.1 Human Effigies: EcNh-1), all sites were comparable as they afford a minimum 160 degrees of view, are on local heights or secondary heights of land, and are within three kilometres of permanent water. The landforms were comparable only as to height (cf. Tables 2, 4). The heights together with the degrees of view may indicate that the occasion of each monument's construction was, to give the builder(s) the best view of the countryside, possibly for defence or hunting considerations. Alternatively, it may provide a hidden or restrained art form which suggests:

> ... the real message of tribal art is not its form or its beauty, but its reminder of the gift of privacy (Carpenter 1978:99).

The adjacency to permanent water may suggest that the monuments were constructed away from the annoyance of stinging or biting insects (eg., mosquitoes, wasps) but within sufficient proximity to water.

It is my personal contention that the majority, if not all, of the boulder monuments were constructed during the warmer seasons of the year. This belief is derived from the fact that the boulders utilized should have formed a portion of the original undisturbed prairie sod matrix. The removal of boulders from the sod in late fall and early spring requires extreme force using a substantial lever, often accompanied by a heating source to loosen the adhering frost (personal observation). In winter boulders are visible on the plains only on the most snow-free, windswept ridges; and are virtually impossible to dislodge from the landscape.

The types of boulder monuments, discussed below (see Table 2), are mentioned in order of the classes defined in Chapter I. My familiarity with the Saskatchewan sites necessitated developing a classification pertinent to the area of personal experience. To justify the classification I have included comparable sites from other areas in the Tables and in the Figures section. In this manner the varieties are based on a larger population sample than is available in Saskatchewan. Consequently the boulder monuments are illustrated in groups using the classification categories defined here, although only the Saskatchewan sites which were all personally observed are discussed in the text. The sites in each class were grouped according to similar form attributes. By this analysis some previously named structures are lumped together, while others are reassigned to different classes. Other previous types are redefined. The ultimate reference to the different classes will be by the Borden and Smithsonian system designations.

4.2 Stone Circles

In this research all stone circles less than 10 metres in diameter are termed habitation circles. Thus habitation circles imply an occupation site. The scope of other lodge types found at an occupation site may include death lodges, dual function lodges, sweat lodges, vision quest structures similar in outline to habitation lodges, menstrual lodges, and child-bearing lodges (Graspointner 1980:64-69). Habitation circles are reported to range in size from 2.5 m to 7.4 m diameter with a mean diameter of 4.6 m (Finnegan 1980:4). Bushnell described the larger stone circles as remnants of a chief's tipi (Bushnell 1922:29), the remains of a communal dwelling (Bushnell 1922: 62), or the remains of a sun-dance lodge (Bushnell 1922:63). However, Maximillian recorded a chief's lodge as being approximately 15 paces across (Thomas and Ronnefeldt 1976:101).

The majority of the Saskatchewan sites, mapped prior to 1975, were scaled in the English measurement system. All maps and illustrations

TABLE 2

IMPORTANT ATTRIBUTES OF SASKATCHEWAN BOULDER MONUMENT SITES

Boulder Monument Type	Height of Land Primary	Height of Land Secondary	Water Source, Maximum Distance [Average]	Number of Associated Stone Circles	Sites With Other Boulder Monument Types	Intra-Site Comparable Aspects By Type	Total Number Located
Medicine Wheels	1	9	500 m [100 m]	4-182*	1	yes	10
Ceremonial Circles	1	10	500 m [100 m]	1-182*	2	yes	11
Effigy Figures							
Animals	5	-	300 m [100 m]	4-23	-	yes	5
Humans	3	1	3 km	1	1	males only	4
Geometrics	1	2	1-300 m 2-3 km [2.5 km]	0.44	-	no	3

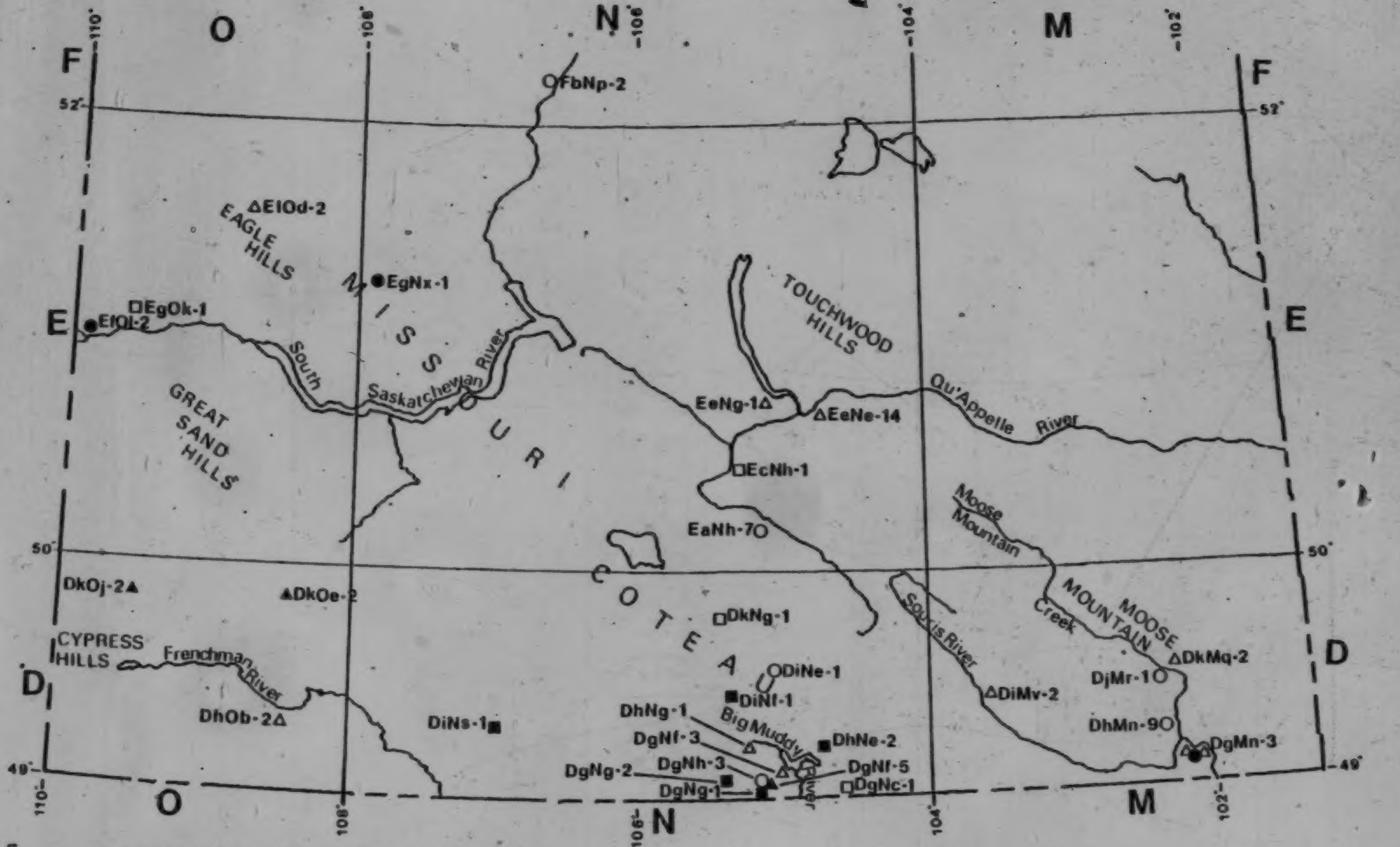
Legend: m - metres
km - kilometres
* - same site, maximum number observed

have been re-scaled in metric dimensions.

4.3 Class I. Medicine Wheels (n = 10)

This popular, "catch-all" group originally included 12 Saskatchewan boulder monuments. Subsequent to this analysis two have been reassigned to the ceremonial circles classification. Of the ten remaining, one (DhOb-2) has been completely destroyed, while two others (DgNf-3) and DhNg-1) have been so drastically altered as to be almost unidentifiable with the original mapped outlines. These medicine wheels represent ten different structures, of which no two are alike by size or configuration. The number of spokes at each site, the individual spoke angles in relation to true north, and the number of boulders used in the construction of each spoke is presented in Table 3. Table 3 lists the individual sites by common names, plus data pertaining to the natural and cultural attributes noted at each site; their distributions are shown on Map 5 along with the other Saskatchewan boulder monument locations. Graph 3 illustrates the complete lack of spoke angle conformity.

The number of boulders in each spoke were counted, and the spoke angles were measured (Table 3) to verify whether the builder(s) conceived a common construction plan. While the number of boulders per spoke varied, a slight similarity of spoke angles was observed in the west and southwest quadrants. The absence of identical construction features prompted me to assume that each of these structures was built to represent separate occasions, and the outlines were added onto until a conceptualized pattern had been achieved. The divergent spoke angles are illustrated in Graph 3. The predominance of four spokes at six of the ten medicine wheel sites (Table 3) may imply a definite pattern, as the numeral four is common in ceremonies among many plains tribes. For


O
N
M
F
E
D
110°
108°
106°
104°
102°
52°
50°
49°
EfOl-2
EgOk-1
ElOd-2
EAGLE HILLS
EgNx-1
FbNp-2
GREAT SAND HILLS
South Saskatchewan River
M I S S O U R I C O T E A U
TOUCHWOOD HILLS
EeNg-1
EeNe-14
EcNh-1
EaNh-7
Qu'Appelle River
Moose Mountain
MOOSE MOUNTAIN
Creek
Souris River
DkOj-2
DkOe-2
CYPRESS HILLS
Frenchman River
DhOb-2
DiNs-1
DkNg-1
DiNe-1
DiNf-1
DhNg-1
DgNf-3
DgNh-3
DgNg-2
DgNg-1
Big Muddy River
DhNe-2
DgNf-5
DgNc-1
DiMv-2
DkMq-2
DjMr-1
DhMn-9
DgMn-3

Map 5 SASKATCHEWAN BOULDER MONUMENT LOCATIONS & BORDEN ZONES

Kilometers.
0
50
100
200
Legend:
△ - medicine wheel
○ - ceremonial circle
□ - human outline
■ - animal outline
● - matoki lodge
▲ - geometric figure

TABLE 3

SASKATCHEWAN MEDICINE WHEEL SPOKE ANGLES AND NUMBERS OF BOULDERS PER SPOKE

Spoke Angles* Sites	N-0° 337°30' to 22°30'	NE-45° 22°30' to 67°30'	E-90° 67°30' to 112°30'	SE-135° 112°30' to 157°30'	S-180° 157°30' to 202°30'	SW-225° 202°30' to 247°30'	W-270° 247°30' to 292°30'	NW-315° 292°30' to 337°30'	# of Spokes	Total Boulders All Spokes
DgMn-3(1)		34°18' (316)		148°58' (288)		227°08' (301)		313°42' (208)	4	1113
DgMn-3(3)		46°11' (38)	91°52' (20)		165°26' 166°32' (191)(327)		253°44' 282°04' (232)(127)	316°39' (169)	7	1331
DiMv-2	18°58' (88)			123°04' (104)		209°35' (121)		300°37' (116)	4	429
DkMq-2	7°48' (39**)(+152)	63°13' (47**)(+90)			176°03' (40**)(+123)	216°18' (294)	284°03' (36**)(+151)		5	970
DgMf-3	15°52' (129)			129°47' (184)	194°52' (133)		284°22' (175)		4	621
DhMg-1***		24°56' (?)			180°31' (?)	213°26' (?)	253°06' (?)		4	Destroyed
DhOb-2		29°36' (31)	67°51' 98°16' (34)(17)			217°26' (17)	264°46' (44)	310°46' (31)	6	Destroyed 174
EeNo-14****	1°17' (113)			155°02' (61)	198°47' (66)		290°02' (82)		4	332
EcNg-1	342°53' (64)		73°58' (62)		163°33' (42)				3	168
ElOd-2		41°34' (63)		135°48' (242)		212°21' (39)		295°08' (66)	4	410
Total Spokes/direction	5	6	4	5	7	6	7	5	45	

Legend: Number of boulders per spoke under angle in parenthesis, where two spokes are located in the same quadrant, the number of boulders in the first parentheses refers to the top angle.

* All angles with declination accounted for, are in relation to 00° as being True North.

** Number of boulders within stone ring surrounding central cairn.

*** Never mapped, destroyed after basic angles were noted, angles measured from interior spoke alignment.

**** No central point of spoke intersection, spoke angles measured from an assumed interior spoke alignment.

example, the Cheyenne pipe ceremony (Powell 1969:17); the Blackfoot Matoki ceremony (Ewers 1958:106) and tobacco dance (McClintock 1923:44); the Cree smoking lodge and Wewahtahokan (Mandelbaum 1979:199 and 183-186, respectively), the Crow high lodge dance (Lowie 1976:436-437); the Dakota fast for visions (Hassrick 1964:271-272); and the Sun Dance among the Bungi (Howard 1977:153), Atsina (Cooper 1956:192), and Sarcee (Jenness 1938:11); all use four as the basic denominator for some ceremonial aspect.

The majority of the 37 medicine wheels defined by this research for the Northwestern Great Plains occur on lands which are, or which have been, occupied by the Blackfoot during the past 400 years. If these features were representative of the Athapaskans who passed through this area, one should also expect to find other concentrations of medicine wheels in the Yellowstone and Black Hills district of their plains settlement. If, as others have stated, medicine wheels were a Cheyenne or other recent migrant Algonkian tradition, these features should be concentrated in the Dakotas and western Montana. However, as the known concentrations are in Saskatchewan and Alberta, it seems more plausible to suppose that they are possibly a Blackfoot tradition. It is possible that the ceremony(s) responsible for medicine wheel construction may have been adopted by other tribes, denoting dispersed occurrences in southern Montana, western South Dakota, and northern Wyoming. Since it is also possible that the Cree and Assiniboine may have built medicine wheels, not all of the Saskatchewan and northern Alberta medicine wheels can be conclusively attribued to the Blackfoot.

A number of different attributes was noted among the ten Saskatchewan medicine wheels. These attributes, when grouped, permitted the determination of the four boulder monument classes listed in Chapter I. This internal division permits a greater range in the possibilities for analysis.

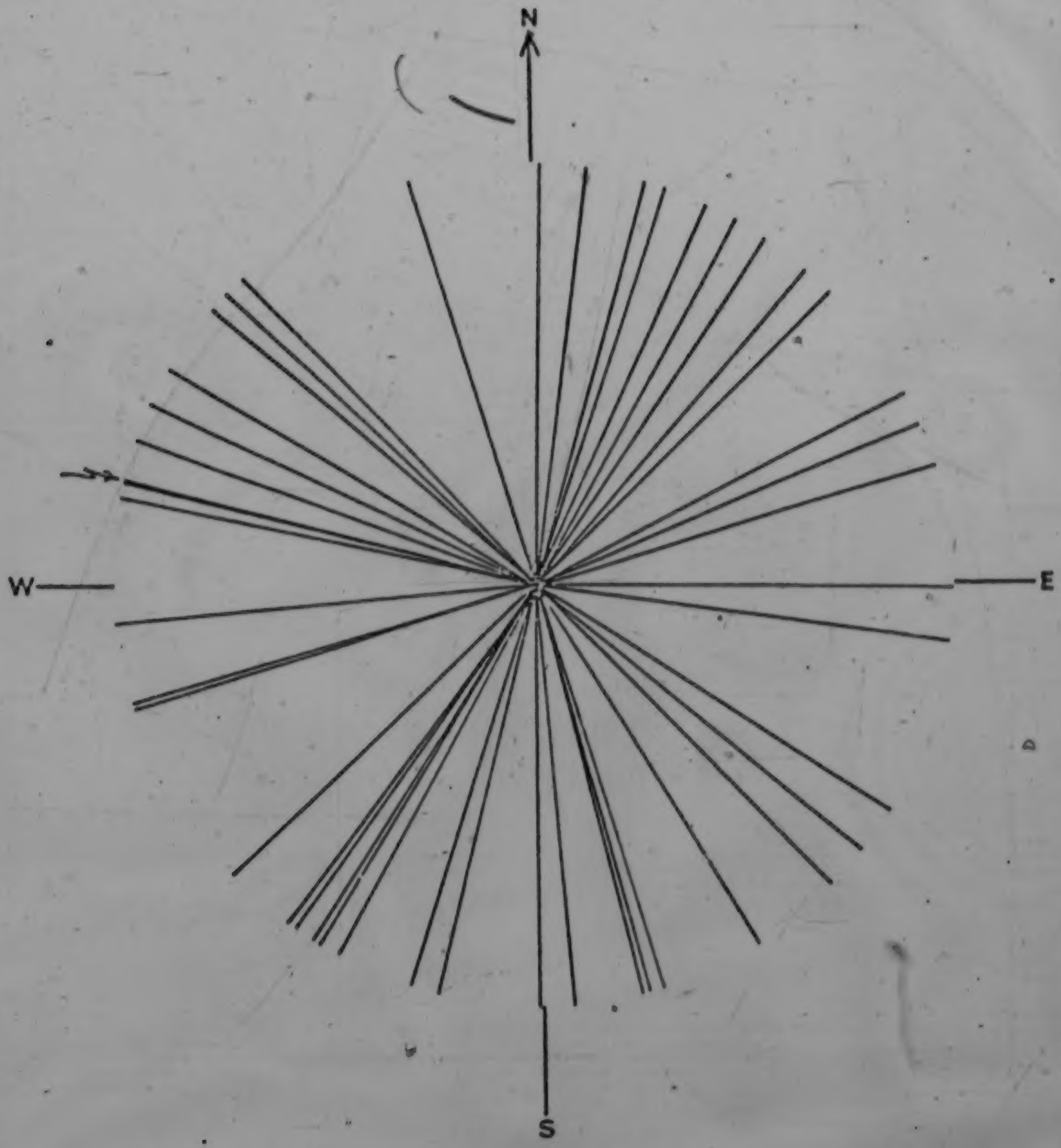
Each of the possible hypothesized medicine wheel subclasses will be discussed according to comparable site attributes. Personal field observations and communications with landowners are added where available. As the observed Saskatchewan medicine wheels are few in number (see Tables 3 and 4), the other recorded Great Plains medicine wheels have been individually assigned with reference to the observed Saskatchewan classes (see Table 5 and appropriate Figures). The medicine wheel class definition stated in Chapter I (page 3) is applicable here. Each subclass will be described with reference to additional site attributes in excess of the spoke angles, individual boulder orientations, and spoke sizes.

Other investigators have hypothesized that medicine wheels pertain to astronomical alignments (cf. Eddy 1975, 1976, 1977, 1979; Kehoe and Kehoe 1979); memorials to war chiefs (cf. Dempsey 1956; Kehoe 1973); burials (Montgomery 1908, Ewers 1955); or sun/thirst dance lodges (cf. Grinnell 1922; Wilson 1981). The following discussions appraise these theories prior to assigning specific sites to this thesis' classes and the interpretation of possible ceremonies which are represented by the four medicine wheel subclasses.

Some researchers avow that medicine wheels were constructed as devices to record annual solstices and stellar alignments as season harbingers. With such recording devices, they assume the native plains occupants devised stellar records as a means of regulating annual ceremonial celebrations. These ancient astronomical studies are termed archaeostronomy or astroarchaeology (Aveni 1977:XII). The notion of astronomy may be correct; however, none of the researchers have devised exact alignments with either the selected stars or summer solstice. The development of astronomy as a calendrical system at the Moose Mountain Medicine Wheel (DkMq-2) was postulated by Kehoe and Kehoe (1979:36) for hunter-gatherer tribes. Though astronomy is normally thought to have been devised by advanced civilizations based on agriculture and having permanent communities and designated scholars with leisure time (cf. Steward 1955:193-194), it is not beyond the realm of possibility for hunting and gathering societies to have developed some basic astronomical observations.

My review of the star lore of the Blackfoot (Wissler 1947:4-26), Pawnee (Fletcher 1902:734), Arapaho (Hilger 1952:84-91), Ojibwa (James 1830:317-323), Assiniboine (Kennedy 1961:8-10), and Cree (Mandelbaum 1979:360) failed to reveal reference to native observations regarding stars which might be Aldebaran, Sirius, Rigel, or Capella - the astronomical alignment stars normally cited in conjunction with medicine wheel structures (Eddy 1974:1038; Kehoe and Kehoe 1979:7, 10). The possible north orientation of Polaris along "Line D-0 at Moose Mountain" (Kehoe and Kehoe 1979:10) is acceptable, as Polaris is termed "night clock" by the Blackfoot (Wissler 1947:8), and was a "directional North Star" for the Pawnee (Fletcher 1902:734). The Ojibwa (James 1830:322) and Cree (Mandelbaum 1979:360) use an unnamed north star for evening directions.

The use of a solstice as a calendrical system with "... an error of a couple of days" (Kehoe and Kehoe 1979:36) may be an unsupportable analysis as there is nothing recorded in Plains ethnology reports which



Graph 3

SASKATCHEWAN MEDICINE WHEEL SPOKE ANGLES

Legend: ↑ - true north (all angle declinations calculated)

→ - angles: 284°22' (DgNf-3) } see Table 3
284°03' (DkMq-2)

specify solstice observations. Since solstices don't affect animals, nomadic tribes following such herds may not have had an interest or use for a longest or shortest day observation. Animal and plant cycles have been noted by Plains inhabitants as aids to their observation of annual events. For example, the Blackfoot abandoned their winter camps when they observed geese flying north and when bison embryo had reached a certain stage of development (Ewers 1955:123-129); the Gros Ventre prepared for their Sun Dance fulfillment "about June or when the spring vegetation was well advanced" (Cooper 1956:185); and:

> When the Dakota saw a certain flower (Liatris punctata) blooming on the prairies, they knew the corn was ripe, and went to the villages of the farming Indians to trade (Griswold 1970:83).

Alternatively, many tribes mention the use of cycles of the moon to define portions or months of a year (cf. Ojibwa - James 1830:321-322; Assiniboine - Kennedy 1961:9). The Assiniboine used winters with noteworthy events to record an individual's age (Kennedy 1961:9; Howard 1976:2).

Finally, John A. Eddy and the Kehoes have developed the astronomical theory mainly for the Moose Mountain and Big Horn medicine wheels. As they have examined all of the known medicine wheels in Saskatchewan, Alberta, Montana, and Wyoming (T. Kehoe, R. Forbis - personal communications), without discovering other comparative alignments, the inclination for astronomical observations as a necessary component of medicine wheels seems inappropriate.

The memorial and burial interpretations for medicine wheels, based on the ethnographic and interview sources (cf. Grinnell 1922; Kehoe 1954; Dempsey 1956), are substantial arguments for the interpretation of certain types of medicine wheels. Montgomery's 1907 (1908:39) excavation of the Halbrite medicine wheel - DiMv-2 (subclass A) - revealed human bone and associated grave goods. The two medicine wheels at DgMn-3 (subclasses A and B) and the medicine wheel at EeNg-1 (subclass A) were reported to have possessed human bone and/or bone bead offerings in their central cairns. Additionally three Alberta sites, DlOv-2 (Fig. 9), EdOp-1 (Fig. 39), and EkPf-1 (Fig. 57), were reported to possess red hematite sometimes used as corpse or bone covering (Wreschner 1980:633) in their central feature cairns (B. Byrne, personal communication). While not all Plains tribes may have used ochre, its presence at some sites may be indicative of continuity in a tribal tradition. The presence of red ochre alone may suggest a surrogate burial.

The medicine lodge hypothesis stated by Grinnell (1922:307) and elaborated on as a thirst dance use by Wilson (1981:355-358), for the Big Horn Medicine Wheel, is a viable alternative if the constructors used the boulder outline as a template for continuing ceremonialism. Elk River identified the Big Horn Medicine Wheel ground plan as "... an old time Cheyenne Medicine lodge" (Grinnel 1922:307). Clements speculated that the Sun Dance originated with:

> ... either the Arapaho or Cheyenne at a time when they occupied a position northeast of their present habitat, but its main development came after they had reached the location they occupied when first discovered (Clements 1931:226).

The presence of a depression in the central cairn possessing "... some fragments of rotted wood" which yielded a dendrochronology date of "1760" (Grey 1963:36), echoes Mooney's (1907:361-363) contention that the Cheyenne ~~have~~ acquired the majority of their ceremonies and tribal identities during the past two centuries, since their migration out of the eastern woodlands.

The possibility of the Big Horn Medicine Wheel representing a former "medicine lodge structure" (Grinnell 1922:307) rather than a site of continuous re-enactments (Wilson 1981:389) is partially substantiated by the Cheyenne acknowledgement that they always rebuilt their medicine/sun/thirst dance lodges, leaving the former structures to return to the elements (cf. Howard 1977:162; Powell 1969:777). Therefore, the possible use of this site as a template for ceremonial consultation may be a more appropriate analysis. The partial use of the site as a boundary marker (Stands in Timber and Liberty 1967:124) also might suggest that the site was a neutral ground for bordering tribes during times of pattern review.

Additionally, M. Wilson's opinion of performing thirst dances only during peak rainfall periods (Wilson 1981:361) suggests a celebrant's skepticism of the value of a ceremony. My personal skepticism is of his rainfall dispersion chart (Wilson 1981:357) which selects three peak June precipitation occurrences for valley locations and the Qu'Appelle location which is in an aspen-parkland environment - non-representative of a plains environment where most medicine sites occur. Finally, Wilson relies on Ojibwa and Cree periods of thirst dance occurrence (Wilson 1981:358). As neither of these tribes were ever associated with the Big Horn Mountains, the use of their time of ceremonial celebration may be inadmissable for comparison.

4.3.1 Subclass A: DgMn-3(1) (Fig. 1); DiMv-2 (Fig. 2); DhOb-2 (Fig. 3); EeNg-1 (Fig. 4)

All of these Saskatchewan boulder monuments possess large central cairns with three to six relatively straight, radiating spokes, although one Alberta example has nine spokes. When originally described, DiMv-2 was noted to possess three spokes (Montgomery 1908:39). Though Kehoe mapped four spokes on DiMv-2 in 1965, only three were relocated during both the 1980 and 1981 thesis researches. The questionable spoke is that which extends to the northwest angle.

DgMn-3, feature 1, possesses a large central cairn and four relatively straight spokes, one pointing to each of the four cardinal compass positions. In addition to this medicine wheel a second medicine wheel of subclass B, a ceremonial circle, and one hundred and eighty-two habitation circles are located on this site. The site extends approximately one kilometre east-west and approximately 200 metres north-south. The majority of the site is located on an ancient island-bar between the present height of land to the south and a river valley to the north of the site. The ancient river drainage to the south of the site possesses numerous flowing springs and one intermittent slough.

DiMv-2 is located on a gravel knob approximately one kilometer east of a minor river valley. This medicine wheel has three spokes and a large central cairn, and originally had five habitation circles associated with it (all were destroyed subsequent to early 1960s' gas well drilling). The entire site area is now slightly less than one hectare in size.

DhOb-2 was destroyed by farming operations in the 1960s'. The medicine wheel had a large central cairn and six spoke lines. The one hectare site is approximately two kilometers south of a major river valley on rolling plains topography. No habitation circles were noted during the initial site mapping (G. Watson, personal communication).

EeNg-1 has a large central cairn and three spoke lines. The spoke lines point toward compass magnetic north, south, and east. The medicine wheel is within fifteen metres of the valley rim of a minor river system.

In addition to the forty-four associated habitation circles, an alignment of twenty-four cairns extends from the eastern side of the site to the top of a small hill approximately one-half kilometre south of the medicine wheel. This site (not including the cairn alignment) occupies approximately ten hectares.

4.3.2 Subclass B: DgMn-3(3) (Fig. 7); DkMq-2 (Fig. 8)

These medicine wheels possess a boulder circle encompassing a central cairn. In both cases the boulder circle is transected by the radiating spokes. DkMq-2 possesses cairns or small boulder rings at the outer ends of each of its five spokes, whereas DgMn-3(3) has one cairn and one small stone ring at the end of two of its seven spokes. This distribution may suggest that this figure is somewhat of a transitional monument between this and the following subclass.

The spoke angles at DgMn-3(3) were measured by E. Krupp of the Griffith Observatory during July 1982 to test astronomical postulations. No astronomical comparisons, as noted for DkMq-2, were deduced from his research (T. Kehoe, personal communication).

The diameters of the two sites' central cairns were noted to be different from each other, and the cairn heights had been previously disturbed. The landowner at DgMn-3(3) admitted to "pulling the central cairn apart as a boy" (personal communication). The height of this cairn is presently one boulder tier (10 centimetres) high. The Moose Mountain central cairn measured 0.85 metres in height in 1980 (personal observations), but when it was first recorded the cairn was "eight feet high (2.4 metres) ... and ... fourteen feet (4.27 metres) in diameter" (Hamilton 1896).

The radiocarbon date of central cairn construction at Moose Mountain

TABLE 4

SASKATCHEWAN MEDICINE WHEEL NATURAL AND CULTURAL ATTRIBUTES

Site Borden Reference	Common Name	(n) Stone Circles Observed	(n) Cairns Observed	Site Location Landform	Water Source stream	Water Source spring	Year Mapped by	Author Year Published
DgMn-3(1)	Oxbow	182	2	Vr/PbI	500 m		1980	*
DgMn-3(3)	Oxbow	182		Vr/PbI		300 m	1980	*
DlMv-2	Halbrite	5		Vr	1 km		1965 K-w	k-k: 1976
DkMq-2	Moose Mountain	30	1	Hr/Hm		350	1962 k-k	K: 1965
DgNf-3	Doug Wade	3		Vr	3 km		1961 K	k-k: 1976
DhNg-1	Bird Foot	?	in alignment	Vr/Hm		1 km	1956 m	*
DhOb-2	Canuck	?		Hm/Tp	3 km		1967 w	w: 1974
EeNe-14	Wilson Russel	23	2	Vr		350 m	1980	*
EaNg-1	Jelly Ranch	45		Vr	1 km		1960 K	w: 1972
ElOd-2	Plenty	28	3	Vr/T		500 m	1965 K-w	k-k: 1976

Legend:
Hm - hummocky moraine
Tp - till plain
Vr - valley rim
Hr - highland rim

T - terrace
PbI - point bar island (glacial stream formation)
* - this research

w - G. Watson
k-k - T. Kehoe & A. Kehoe
m - B. McCorquodale
K - T. Kehoe

TABLE 5

NON-SASKATCHEWAN MEDICINE WHEELS

Recorded Designation	# of Spokes	Variety	Associated Features	References	Text Figure
Eagle Child	4	C	-	Dempsey 1956	-
Steel	4	C	-	Dempsey 1956	21
DlPi-2	6	C	-	ASA 1976	22
DkPf-1	4	C	-	Quigg 1984	26
DlOv-2	6	B	1a	ASA 1976	9
EaOs-2	5	A	-	ASA 1976	5
EbOm-1	6	C	s?,c?,a?	Quigg 1984	27
EcOp-4	11	B	14s,3a	ASA 1976	10
EdPc-1	26-28	D	s?	Calder 1977	31
EdPi-2	4	D	15s	ASA 1976	30
EfOo-10(1)	9	B	1s,7c	ASA 1976	14
EfOp-58	4	A	5s,3c	ASA 1976	6
EgOx-1	8	B	2a,1c	ASA 1976	11
EgOx-29(1)	16	B	10s	ASA 1976	12
EgOx-29(2)	7	B	9s,4a,2c	ASA 1976	13
EgOx-46	17	C	c?	Quigg 1984	28
EkPe-3	5	C	2s,1a,8c	ASA 1976	23
24BH220	6	C	-	Brown 1963	24
24BH747	4	C	s?	Quigg 1984	25
24BL331	5	-	5s	Deaver 1980	-
24HL81	-	-	201s,18a,18c	Deaver 1980	-
24HL87	13	-	38s,11a	Deaver 1980	-
24HL169	9	-	97s,17a,25c	Deaver 1980	-
24TT67	10	B	s?	Kehoe 1954; Newcomb 1967	15
48BH302	28	D	8s	Grinnell 1922; Wilson 1981	32
39HD22	4	D	-	Rood and Rodd 1983	29
Custer	5	B	s?	Over 1941	16

Legend:
s - habitation circle
a - alignment
c - cairn
? - number not reported
- - information not available
ASA - Archaeological Survey of Alberta

was noted to be 440 B.C. (Kehoe and Kehoe 1979:42). It should be noted that this date corresponds to the central cairn only. John A. Eddy (1979:165-168) acknowledged this discrepancy, and postulated that some alignments at this site might represent continuous use of the facility from the date of construction through to historic contact. The reuse was noted in 1982, as local Assiniboine and Saulteaux Indians have been reconstructing portions of the Moose Mountain outline. Presumably many conquering and conjuring tribes used previous monuments to fit their own ideology through rearrangements of existing outline patterns (*cf*. Howard 1972:300).

4.3.3 Subclass C: DgNf-3 (Fig. 17); El0d-2 (Fig. 18); DhNg-1 (Fig. 19); EeNe-14 (Fig. 20)

These features lack a central cairn or cairns at the end of the radiating spokes, although each possesses four spokes; and they are located on or near the rim of a valley complex. DgNf-3 had two stone circles within the spoke alignments. Forty-four stone circles are located 100 metres to the northwest of El0d-2. Numerous stone circles were originally reported north of DhNg-1. EeNe-14 has 26 stone circles to the north and west of it, and had numerous other stone circles in the now-cultivated field to the east. The central area of spoke intersections at DgNf-3 and El0d-2 are at the apex of their hill location, whereas the areas of spoke articulation at DhNg-1 and EdNg-14 appear to be a slight prehistoric man-made rise in the topography.

4.3.4 Subclass D: EePi-2 (Fig. 30); EdPc-1 (Fig. 31); 48BH302 (Fig. 32); 39HD22 (Fig. 29).

Among the twenty-seven medicine wheels outside of Saskatchewan (see Table 5), four did not fit into the previous three-variety system. Of these EePi-2 and EdPc-1 are in Alberta, 48BH302 is in Wyoming, and

39HD22 is in South Dakota. Rather than omit them, a fourth subclass was established. This variety is regarded as tenative, as none of these sites were visited and all site information was derived from other sources. This interpretation is presented so that all known medicine wheels might be represented in a single, encompassing volume.

All Subclass D medicine wheels are represented by spokes which radiate from a central cairn or intersection and terminate at the inner edge of an encompassing boulder circle. In all cases associated stone circles are lacking, few in number, or not mentioned in the research report. Both the Majorville Cairn (EdPc-1) and the Big Horn Medicine Wheel (48BH302) are located prominently, affording a commanding view of the surrounding topography. Both features have been excavated and dated according to materials retrieved from their cairns. The disparity of dates obtained for their constructions may be attributed to the fact that the Majorville radiocarbon date was from bone in a disturbed buried level in the central cairn (cf. Calder 1977:42), whereas the Big Horn dendrochronological date was obtained from a wood sample in the original construction level of the west cairn (cf. Grey 1963:36). Support for the Big Horn date was confirmed by the retrieval of a side-notched point immediately under a stone on the northwest encompassing rim (Wilson 1981:364).

4.3.5 Other Medicine Wheels Outside Saskatchewan

Of the 27 medicine wheels which this study defined beyond Saskatchewan's borders, 17 were located in Alberta, seven in Montana, one in Wyoming, and two in South Dakota (see Table 5 and Figures). Where possible the out-of-Saskatchewan medicine wheels have been classified into the four subclasses described. The absence of additional site information from most sources restricts further comparisons. Available illustrations are grouped by the defined subclasses in the figures section (Saskatchewan sites are illustrated one to a page, whereas the out-of-province sites are grouped up to four sites per page). The references quoted in Table 5 are published reports and some secondary sources. Four Montana medicine wheels (Deaver 1980) were included because the site reports contained sufficient information, without being illustrated, to define medicine wheels adequately.

4.4 Class II. Ceremonial Circles

The term 'Ceremonial Circle' was devised by T. F. Kehoe and Gil C. Watson in 1964 to define stone circles larger than those which are presumed to have represented habitation circles (G. C. Watson, personal communication). The term incorporates all stone figures in excess of ten metres diameter, or of a size larger than the range for habitation circles of between 6 to 30 feet (1.2 to 9.1 metres) in diameter (Kehoe 1960, Loendorf 1970, Adams 1978).

Ceremonial circles are located also on past and recent historic Blackfoot territories. While not numerous nor showing concentration areas, they do seem to illustrate a line pattern extending from the west side of Lake Manitoba through Saskatchewan into central Alberta. Although a concentration doesn't seem to exist for the 12 ceremonial circles in Alberta (see Map 6), the occurrence of the majority of them on traditional Blackfoot territory (extending south into northern Montana) seems to suggest that they could have been of Blackfoot origin. Their use by other tribes (cf. Watetch 1959:22; Thomas and Ronnefeldt 1982:101) in Saskatchewan and Montana suggests that others may have adopted them for either ceremonies or other uses.

The differences in ceremonial circle exterior and interior boulder configurations together with personal observations were used to formulate the subclasses. Since some of those subclasses appear to be similar, based on construction details only, some ethnographic analogies reminiscent of each subclass are presented in Chapter V to clarify those assumed classifications.

Previously, enlarged boulder circles were not differentiated from smaller stone circles as separate functional entities. Recent research has revealed ceremonial-related characteristics which should allow definition of a number of varieties between these large circles. Also, this classification includes boulder circles in excess of ten metres diameter with enclosed and/or peripheral boulder features. The varieties of interior and peripheral boulder features are discussed below and listed in Tables 6 and 7.

4.4.1 Subclass A: (n = 3), DgMn-3(2) (Fig. 34); EgNx-1 (Fig. 35); EfOl-2 (Fig. 36)

The similarities of outline construction at DgMn-3(2), EgNx-1, and EfOl-2 suggest they may reflect a similar celebration event. All three possess a large boulder circle with boulder lines articulating with the periphery, suggesting a definite entrance or pathway. The scattered boulders in the interior at DgMn-3(2) suggest a small disturbed cairn. My conversations with the landowner of this site revealed earlier excavations of the two central cairns of the two medicine wheels found on the same site. Therefore, it may be reasonable to assume that if a cairn had existed at this feature, it too has been disturbed. The outline at EgNx-1 differs from DgMn-3(2) by the presence of a large central cairn beyond the boulder circle periphery to suggest a chute or pathway. The third line, between the two chute lines, begins beyond the encompassing

TABLE 6

SASKATCHEWAN CEREMONIAL CIRCLES

Borden Number (Common Name)	Circle Diameters (metres) N-S	E-W	$\bar{x}$	Other Immediate Structures	Associated Site Features	Degrees of View	Landform Topography	Water Source Distance/ Direction	Variety (Text Figure)
DgMn-3(#2) (Oxbow)	15.2	14.2	14.7	Dc,2el	182s,2mw,2c	360	PbI,Tp	river (300m-N)	A (34)
DhMn-9 (Alameda)	15.9	16.1	16.0	B	1s	270	Tp	river (500m-E)	B (44)
DjMr-1 (Forget)	22.5	21.5	22.0			360	K,Tp	spring (150m-SW)	B (45)
DgNg-2 (Dick Giles)	17.5	25.9	21.7	dl	9s	160	Fp	spring (50m-NE)	D (59)
DiNf-1 (Ogema)	32.0	30.5	31.3	Dc,dc	3s	90(x2)	KK,Tp	spring (1km-NE)	C (52)
EaNh-7 (Claybank)	41.9	31.7	36.8	B,sb	5s	270	KK,Tp	spring (450m-SE)	B (46)
EeNu-1 (Perrin Ranch)	19.0 15.5			C,Dc, C,Dc,	7s,c 7s,c	360 360	Vr,Tp Vr,Tp	river (1km-S)	B (47)
EgNx-1 (Houghton)	7.5	7.1	7.3	Cc,3il		270	KK,Tp	spring (500m-SW)	A (35)
EfOl-2 (Roy Rivers)	25.2	26.6	25.9	Cc,dc,2il	1s	360	Vr,Tp	river (1.5km-S)	A (36)
FbNp-2 (Cronk's)	14.9	15.1	15.0	Cc,sb	1s	360	Vr,Tp	river (300m-S)	C (53)

Legend:
Dc - disturbed cairn
el - exterior lines
B - central boulder
dl - interior disecting line
dc - diameter cairn
sb - scattered boulders interiorally

C - ceremonial circle
Cc - large central cairn
il - interior boulder lines
PbI - glacial point bar island
Tp - till plain
K - knob
Fb - flood plain

KK - knob and kettle
Vr - valley rim
s - stone circle
mw - medicine wheel
c - stone cairn
m - metres
km - kilometres

TABLE 7

CEREMONIAL CIRCLES OUTSIDE SASKATCHEWAN

Site Reference	Average Diameter (metres)	Variety	Site Features s	Site Features a	Site Features b	Site Features c	Structure Features	Text Figure	Reference Source
DgOp-38(26)	19.0	A	19	4	4	1	scc,ep	37	Graspointner 1980
DhPb-2	13.4	A	2	2		1	lcc,ep	38	ASA
EdOp-1	27.9	A	26	2		4	lcc,ip	39	ASA
EdOq-30	19.7	C				1	scc	58	ASA
EfOo-24	17.6	C	13				lcc	54	ASA
EfOq-36	14.0	A	9	1			lcc,ep	40	ASA
EfOq-65	20.0	A					lcc,ep	41	ASA
EhOp-1	22.5	C					lcc,ep	55	ASA
EgOo-10(2)	15.4	C	20	1	1	8	lcc,2pc	56	ASA
EaPe-1	26.0	A				4	lcc,ec,ep,ip	42	ASA
EgPn-53	10.9	A					scc,ep	43	ASA
EkPf-1	17.4	C		1		1	lcc	57	ASA
24HL160	30.0	B	402	6	24	27		-	Deaver 1980
GRC-81-2	23.0	B			1	3	scc	-	Deaver 1980
Morstad	23.9	B	6		1	2	scc,2ea	49	Jerde 1979
Alonsa	14.5	B				2	scc	50	Rutkowski and Westcott 1979
Dand	9.75	B	1	5		1		48	Tamplin(unpublished)
	19.8	B					ea	-	Syms 1970
DkLw-18	19.3	B						51	Nicholson 1980

Legend:
s - stone circles
a - alignment
b - semicircle
c - cairn
scc - small central cairn
lcc - large central cairn
ec - enclosed circle
ep - external passageway
ip - internal passageway
ea - enclosed alignment
pc - peripheral circle cairn
ASA - Archaelogical Survey of Alberta 1980

circle and extends to a distance equal to the ends of the other two lines (Fig. 35).

Kehoe and Kehoe (1979:15) suggest a possible summer solstice marker for EfOl-2 using an alignment from the large central cairn through an interior "sunburst feature." When first observed in 1915, the feature was described and shown (Fig. 60) to possess only the central cairn and the northwestern peripheral cairn (Begg 1915). My site examination in 1980 revealed that the smaller central cairns within the encompassing circle lay high on the prairie sod, suggesting recent placement (between the time of initial observation and the 1964 feature map).

Seven out-of-province features comparable to these three structures are presented in Figures 37 to 43. When compared all reveal similar, though not exactly the same, characteristics (also see Tables 6 and 7).

4.4.2 Subclass B: (n = 5) DhMn-9 (Fig. 44); DjMr-1 (Fig. 45); EaNh-7 (Fig. 46); EeNu-1 a & b (Fig. 47)

The ceremonial circles in this variety all possess a continuous peripheral boulder circle, and all display either a single large central boulder or a construction to suggest some form of an amphitheatre arrangement. A reverse amphitheatre form was noted at EaNh-7 (Fig. 46), where the hill apex was 2.3 metres above the elevation of the encompassing boulder circle. The large dolomite boulder at this circle's centre may suggest a speaker's platform. Similarly, a 0.5 metre dolomite boulder in the center of the DhMn-9 circle may have served the same function. At DjMr-1 the circle centre was recorded to be 0.4 metres below the circle's perimeter elevation. While the two circles at EeNu-1 were both relatively level across their diameters, they shared one other feature common to the other three circles - all were noted to be distant from any stone habitation circles. In each case stone circles were observed to be placed a minimum 275 metres distant from the ceremonial circle(s). The larger circle at EeNu-1 had a line of small cairns extending 35 metres toward the seven stone circles. These two large circles were located on a hill apex, permitting a 360 degree view of the surrounding topography (see Table 6). Possible uses for these and other subclasses of ceremonial circles are speculated upon in Chapter V.

4.4.3 Subclass C: (n = 2), DiNf-1 (Fig. 52); FbNp-2 (Fig. 53)

These ceremonial circles will be discussed as "Enclosed Cairns," as all seven (including the five sites beyond Saskatchewan) consist of a large central cairn completely surrounded by a boulder ring. These features (see Table 6) are situated on relatively level areas at the edge of local prominent heights of land in Saskatchewan.

FbNp-2 (Fig. 53) affords a complete view of the upland plains together with a view of a portion of the valley and of the South Saskatchewan River. As a site marker to denote a particular coulee, it would have been evident from a variety of locations. Extensive surveys and site test excavations by the Department of Antrhropology at the University of Saskatchewan have revealed the presence of numerous sub-surface sites, including a buffalo pound in a nearby ravine (E. Walker, personal communication).

DiNf-1 (Fig. 52), located on a northward extension of the Missouri Coteau, permits two 90 degree views (which may be as advantageous as a single 180 degree view; see Table 6), one view to the east and one view to the west of the site. The site is located on a small depression or saddle between the southern uplands and a northern knob landform. Vision toward the south permits a maximum view of the upslope landscape to a distance of 0.5 kilometres; however, the knob rises abruptly within ten metres north of the feature to an elevation of eight metres higher than the site. A natural spring, located to the northeast of the site, has never diminished its volume over the past 40 years (personal communication with the landowner). As such, this figure might have served as a marker for a fresh water supply. Stones from the central cairn at DlNf-1 are now scattered throughout the central circle area.

4.4.4 Subclass D: (n = 1), DgNg-1 (Fig. 59)

This site does not have a known comparative form on the Great Plains. While the outline is somewhat elliptical, no other large circle possessed a central line almost dissecting the circle into two halves. The other contributing factor, to justify a separate variety, is that this figure is within a valley complex adjacent to a stream on one side and nine stone circles on the opposite side (see Table 6). In all other cases, the ceremonial circles occupied higher topographical locations. The only other ceremonial circle directly associated with stone (habitation) circles was the ceremonial circle at DgMn-3. All other large circles are removed from any habitation proximity.

4.5 Class III. Effigy Figures

These figures are divided into animal and human outlines for ease of discussion. Boulder outlines of animals show various fauna in saggital, dorsal, or ventral views. Most human figures were depicted from a ventral view, though one boulder outline illustrates the head and upper torso ventrally and the lower body in saggital section.

4.5.1 Subclass IIIa. Animal Outlines

In Saskatchewan animal outlines were located on local heights of land, usually at or near the edge of a valley rim. All of these outlines are associated with habitation circles. While habitation circles were not described for most of the out-of-province sites (Table 8), different types of dwelling structures might have been located in the vicinity of those sites.

The five animal boulder outlines have been interpreted previously as three turtles, one bison, and one salamander. Two of these monuments were removed from the original sites when the landowners expressed a desire to increase their cultivated acreage. Those two monuments have been reconstructed in a local wildlife park. However, the deficit of ancillary site data at these two sites made comparisons with other similar outline constructions impractical. Therefore, both sites were analysed according to possible individual feature representations. One of the three turtle outlines was redefined because its outline was significantly different from the other two figures.

4.5.1.1 Turtle Effigies (n = 2), DgNg-1 (Fig. 61); DiNe-1 (Fig. 62)

Both turtle monuments depict the animal from a dorsal view (eyes on top of the head), and show the head wider than the neck. Both examples show a carapace with outlined feet protruding anteriorally (forelegs) and laterally (hindlegs), and displaying claw-like appendages. The tails are depicted at both sites as short 'nubs' terminating in straight boulder lines. DgNg-1 (Fig. 61) was located within five metres of a valley rim, with the head directed away from the creek in the valley. As the precise location on DiNe-1 (Fig. 62) was not noted on the original site report, the direction of head alignment to-

TABLE 8

ANIMAL BOULDER MONUMENTS ON THE NORTHERN GREAT PLAINS

Site Designation	Site Name or Location	Animal(s) Duplicted	Monument Size (Metres)		Internal Features	Ancillary Features	Landform Topography	Water Source (Dist.)	Text Figure Number	References
			Length	Width						
DgMg-1	Fat Giles Turtle	Turtle	10.55	14.20	c	6sc	Vr-Tp	creek (120m)	61	SMNH
DgMh-3	Big Beaver Buffalo	Bison	10.48	4.68		23sc	Vr-Tp	spring (1.5km)	72	SMNH
DhNe-2	Minton Turtle	Badger*	41.96	26.07	hl,al,c	9sc	Vr-Tp	lake (3.5km)	73	SMNH; Kehoe & Kehoe 1979
DiNe-1	Hardy Turtle	Turtle	26.50	17.08	cl	7sc	KK-Tp	creek (200m)	62	SMNH
DiNs-1	Mankota Salamander	Salamander	10.55	4.64		7sc	KK-Tp	creek (200m)	74	SMNH
	Consort Site	Turtle Snake	3.66 8.05	3.05 .57			R-Tp		63	Bayrock 1963
EaKv-3	Bannuck Point	Turtle Snake Snake	2.57 3.90 35.66	1.75		e,gf,c	Bedrock		64	Sutton 1965
EaKv-12	Rainbow Falls	Turtle Turtle	3.05 2.74	1.96 2.46			Bedrock	river (50m)	65	Sutton 1965; Steinbring 1980
EaKv-13	Basket Falls	Turtle	12.80	3.2			Bedrock	river (50m)	66	Steinbring 1980
EaKv-14	Tie Creek	Snake	20.66			al,c,gf,e	Bedrock		75	Buchner 1976a; Steinbring 1980
EaKv-17	Pine Point Snake	Snake	2.40				Bedrock		76	Buchner 1976a; Steinbring 1980
EaKv-20	Pine Point Linear	Snake	NA	NA			Bedrock	river (200m)	77	Sutton 1965
	Lac du Bois	Snake	13.01						78	
	Petroform	Snake	6.70				Bedrock		78	Steinbring 1980
EaLa-6		Snake	1.5						79	Steinbring 1980
24PH1707		Snake	14.0	6.0		15ae,3c,al	Vr-Tp	lake (500m)	-	Deaver 1980

Site Designation	Site Name or Location	Animal(s) Depicted	Monument Size (Metres)		Internal Features	Ancillary Features	Landform Topography	Water Source (Dist.)	Text Figure Number	References
			Length	Width						
39HU70	Hughes County	Snake Turtle	82.3 10.76	 5.56	* al/h				67	Over 1941
39HU74	Hughes County	Turtle Snake Bird	2.70 159.11	1.83 3.6	hl		Vr-Tp	river (120m)	68	Over 1941; Lewis 1889
	Custer County	Rabbit	NA	NA		gf			80	Over 1941
	Jerauld County	Turtle Snake	4.57 47.8	2.94		h,c		river (?)	69	Over 1941; Todd 1881; Lewis 1891
	Minnehaha County	Turtle Fish	NA NA	NA NA		mound		river (?) river	70	Over 1941
Nebraska		Turtle	4.19	3.05	c		Vr	(200m)		Gilmore 1932
Minnesota	Murray County	Bison	2.95	1.62	e	al,c,smsc			81	Lewis 1890
North Dakota	Oliver	Turtle	4.63	3.1	cl		Vr	river	71	Libby 1910

Legend:
c - cairn
hl - heart-line
al - alignment
smsc - small stone circles
Dist. - distance from the monument to a water source
* - redefined this research
NA - not applicable
cl - center line
e - eyes
al/h - head alignments
sc - stone circles
gf - geometric figure
h - human figure
Vr - Valley rim
Tp - Till plain
r - ridge

ward or away from a water source was not accurately defined. The boulder line extending from the tail straight to the neck at DiNe-1 may indicate a direction toward a water source or an indication of a straight-flowing water source.

DgNg-1 is located 18 metres west of five occupation circles and within 1 1/2 kilometers of a ceremonial circle and a suspected war lodge remnant. Both of these other sites are associated with occupation circles, although only the war lodge site is within the view of the turtle effigy. The absence of additional site information at DiNe-1 precludes any estimation of its association with occupation or other sites, as the entire original area is now completely cultivated.

4.5.1.2 Badger Effigy (n = 1), (Fig. 72)

DhNe-2, originally titled the "Minton Turtle" (Kehoe 1965:1, 6), was reinterpreted by me because of differences from the two turtles previously described. During the initial investigations I was perplexed by the disparity of head, legs, tail, and internal features displayed by this effigy. To elucidate the problem, I consulted with two Saskatchewan native informants for their interpretation. All three Saskatchewan "turtle" outlines were shown to the two informants, indedependent of one another. Both Don Pinay (Cree) and Jim Ryder (Assiniboine) identified the turtles, confirming their published identities; however, both immediately identified the Minton Turtle as a badger outline (personal communications, June 1980 and September 1980, respectively).

The head on this effigy was depicted with eyes, nostril opening, mouth, and ears. My initial dissatisfaction with the turtle definition had been due to the ear protrusions, characteristics not found on any turtle. Subsequent investigations revealed that when a turtle is lain on its back the mouth appears as a slit along the proximal edge of the head, completely without eye or nostril view. Conversely, when a turtle was depicted dorsally, the eyes should have been located laterally on the head without a mouth depiction. The legs depicted on this feature are shown as single boulder lines extending out to semi-circular boulder outlines, without claws (as were noted for both the turtles). The large boulder cairn in the centre of the figure, coupled with a boulder heart line anteriorally and straight boulder line posteriorally, were noted as non-turtle monument characteristics. Additionally, the tail was depicted as a short stub with a boulder line across it and without the extending boulder line away from its end.

During mapping operations, local informants reported the presence of "human bones in the central cairn" (G. Watson, personal communication). Research into early SMNH archaeological daily log books revealed a conversation between the initial site reporter and the museum's investigator. The contents of that diary reveal that:

> During a conversation with Mr. Leon Uyttenhager ... he stated that he had visited the Turtle Effigy in 1917 and had noticed a large white boulder perched upright on top of the central pile of stones. This ~~boulder had a face~~ and numerous other marks incised in it. During the following year (1918) he visited the site and noticed that the boulder (petroglyph) was missing. Mr. Uyttenhager also informed me that during a visit to the site several years after 1918 he observed evidence of an excavation into the central pile of rocks together with the presence of human ribs in earth removed in the excavation (McCorquodale, March 1, 1961).

4.5.1.3 Salamander Outline (n = 1), DiNs-1 (Fig. 73)

Depicted from a dorsal view (lack of eye depiction), the Mankota Salamander is an anomaly on the Great Plains. Although first recorded in 1962, the effigy was not mapped until T. F. Kehoe began a project to record boulder monuments in Saskatchewan. After it was mapped in 1964, the outline was defined as that of a Tiger salamander (Ambystoma tigrium) by a University of Regina biologist (T. F. Kehoe, personal communication). The absence of associated site features prohibits better site analysis. In 1966 the landowner contacted SMNH expressing a desire to cultivate the land. Following a detailed recording of each boulder's alignment, the effigy was removed to the Condie Wildlife Park north of Regina. When reassembled, the park authorities thought it necessary to cement each boulder into place to prevent future boulder thefts or rearrangements.

4.5.1.4 Bison Effigy (n = 1), DgNh-3 (Fig. 74)

The Big Beaver Buffalo effigy, located on a prominent hill, is within a habitation camp of 23 stone circles. The effigy is located 32 metres from the crest of a coulee which descends toward the south, opening into a minor valley half a kilometre from the site. The valley has a small oxbow creek which seasonally drains to the east. The creek maintains small pools of water only until mid-summer. A second coulee to the west possesses a flowing spring which supplies water to a small slough in the valley, approximately two kilometres upstream from the hill upon which this site is located.

The effigy's head is lowered, possibly depicting a pre-charge stance. The lowered tail, however, should denote that the animal pictured is not charging. The head points toward the valley, while the feet point east toward the first coulee. An indistinct heart-line is depicted. The presence of two large boulders ventrally to the tail may suggest the male gender, though no penis is depicted.

4.5.1.5 Other Animal Effigies

An additional 13 turtle effigies (cf. Steinbring 1980 [n = 9], Bayrock 1963 [2], Will 1921 [2]), three snake effigies (cf. Steinbring 1980), and a bird effigy (cf. Over 1941) are known for the northern Great Plains. Lewis (1890:271) reported three animal effigies with the Minnesota bison, which had been identified as "resembling a crane, a turtle, and a bear" (Hudak 1972:245). The lack of illustrations and comparable site information precluded inclusion of these 21 effigies in Table 7.

4.5.2 Subclass IIIb. Human Effigies

Human effigies are the second most common animalistic boulder monuments but the best described (cf. various authors in Table 9). The 17 recorded human boulder outline sites on the northern Great Plains account for 19 human figures, of which 11 were identified as males and six were females. The two remaining figures did not possess depictions suitable to definitions of gender.

4.5.2.1 Saskatchewan Human Effigies (n = 4); DgNc-1 (Fig. 83); DkNg-2 (Fig. 84); EcNh-1 (Fig. 85); EgOk-1 (Fig. 86)

Both DgNc-1 and EgOk-1 outlines share common figure and site characteristics. Both figures have the head oriented toward a northerly direction; both figures are accompanied by a single stone circle (cf. Dyck 1981; Gill and Hymers 1968); both are located approximately five kilometres southeast of an alkali lake; both are shown with the arms in an elevated position; and both possess a boulder heart-line.

The Wildman Butte site at DgNc-1, a human outlined figure (Fig. 83), could be of Ojibwa origin as was suggested by Dyck (1981); however, its location in southern Saskatchewan might represent an Assiniboine figure also, as the Yanktons were noted to use pictograph symbols (cf. Howard 1976). When first observed in 1863 the Wildman Butte site (DgNc-1) was described as:

> ... the peak we passed yesterday ... It is quite flat on the top and in the earth is the prostrate form of an elk cut in the ground by the Indians. The body is about 12 feet long, the antlers are very large, and in the place where the body is excavated is a round stone four inches in diameter painted red with some strips of red cloth beneath it. On a less elevated peak adjacent is the large figure of a man with his feet south and his toes east. Nothing but the outlines are made which are of round stones eight inches in diameter embedded in the earth. His length from head to foot is 36 feet. Across the shoulders nine feet, from hand to hand which are in an elevated position 18 feet and in his right hand is a bow and arrow (Clandening 1928:260).

While this basic description fits the Wildman Butte human effigy, the definition of gender was omitted, possibly due to the vaguness of the penis structure location or because of Victorian modesty. The sex may have been assumed on the basis of the bow and arrow, tools attributed to males.

The Cabri Lake Human Effigy at EgOk-1 (Fig. 86) is the other Saskatchewan male human effigy. Gender was positively defined by the boulder depiction of two testes and a penis. Other similarities between this figure and DgNc-1 are an outlined trunk, feet pointing toward the figure's left, a definite heart-line, and elevated arms. Both legs are outlines filled with boulders from the hips to the knees, with single boulder lines from the knees to the toes of the feet. The arms and neck are single boulder lines; however, the 1964 illustration appears to have fingers depicted. When first sketched,the hands appeared as circular boulder rings (see Fig. 86, b insert). The original map was sketched by V. A Vigfusson in 1938, who noted that the site had been discovered in 1903 (Sewell 1944). Unfortunately, neither Vigfusson nor the original observer wrote any figure observa-

TABLE 9

NORTHERN GREAT PLAINS HUMAN BOULDER OUTLINES

Site Designation	Name	Gendre	Head(Toward) Direction	Internal Boulders	Ancillary Features	Text Figure Number	References
DgMc-1	Wild Man Butte	M	N	Hl,mo,b	sc	83	Kehoe 1965; Clandening 1928; Dyck 1981
DkNg-2	Kayville	F	S	+	9sc	84	Watson 1975
EcMh-1	Dewdney Avenue	F & ?	W	e,br,b	r	85	This research
EgOk-1	Cabri Lake	M	ENE	Hl,k,p,+	sc,c	86	Watson 1976; Kehoe 1965
EfOs-36	Ross Medicine Wheel	M*	WNW	Hl,p,+	c,al	87	ASA
EkPf-1	Rumsey Cairn Medicine Wheel	?	WSW	+	lsc	88	ASA
	Consort	M	WSW	Hl,p,+	sc,c	89	Wormington and Forbis 1965
	Cluny	M	S	+	al	90	Kehoe & Kehoe 1957
	Steveville	M	SE	Hl,p,+		91	Bryan 1968; Kehoe 1965
EaKv-14(1)	Tie Creek Site	F*	SSE	Hl,br,b	al	92	Buchner 1976a; Steinbring 1970
EaKv-14(4)	Tie Creek Site	M*		Hl,+		93	Buchner 1976a; Steinbring 1970
24GA106	Bozeman	M	W	p,+		94	Malouf 1975; Kehoe & Kehoe 1957
	Pryor East	F		v,+		95	Simms 1903b: Fig. 75
	Landslide Butte	M		p,+		96	Kehoe & Kehoe 1957
	Wessington Springs	F	NNE	e,m,+	sc	97	Todd 1886; Lewis 1891
	Punished Woman's Hill	M & F	NW	M:p,+ F:br,v,+	c,al	98	Lewis 1889
	Murray County	M	NW	+		99	Hudak 1972

Legend:
M - Male
F - Female
? - Sex indeterminant
N - North; S - South; E - East; W - West
Hl - Heart line
sc - stone circle
e - eyes
p - penis
br - breast
v - vagina
al - alignment
c - cairn
lsc - large stone circle
m - mouth
* - gender defined by this research
b - body outline
+ - stick body depiction
ASA - Archaelogical Survey of Alberta
r - Rectangular boulder configuration

tions. The 1938 illustration also shows a well-formed head without a neck. The absence of boulders in the lower trunk, as shown at EgOk-1, in other human male effigies might suggest that the individual after which this outline was fashioned may have had two lateral birthmarks, two body scars, or suffered from abdominal hernias. Originally I viewed the two boulders as kidney depictions; however, when reviewing other human effigy depictions, other than heart-lines, all boulders represented surface features of the body. Therefore, it was assumed that these boulders may have represented a surface stomach anomaly.

Gill and Hymers (1968:26-27) made pertinent observations when studying this site in 1967 to the extent of measuring and recording six associated cairns and a stone circle. None of these features had been mentioned during the 1964 site recording. The stone circle suggests a site comparison with DgNc-1, even though the figure orientations are different at each site. The presence of cairns in 1967 (absent in 1980) confirms some of Vigfusson's 1938 observations of:

> ... mounds of stone which had been dug into - four of them 1 (one) N.E. (northeast) - 3 (three) W (west) several artifacts (Sewell June 28, 1944:1938 notes).

By 1980 only the effigy survived to indicate a site.

The small configuration at DkNg-2, the Kayville Human Effigy (Fig. 84), is the smallest human effigy located in Saskatchewan or known in any other publication record. The figure was completely surrounded by a boulder square. The figure was located on a high hill in knob and kettle terrain, with water available seasonally in sloughs located in the kettle depressions. The absence of habitation circles at this site and all other human effigy sites in this research indicates that all of these sites possibly represent a single individual's monument, medicine, or petition to some deity. The lack of definite gender depiction may suggest the representation of a female figure (no genitals depiction).

The Dewdney Avenue Human Effigy located at EcNh-1 (Fig. 85) is the only Saskatchewan human effigy located in a valley. The outline apparently depicts a seated female with a child upon her knee, the child's head being level with her breast. The female's face is portrayed by the presence of eyes only, whereas the child's face is complete with eyes, nose, and mouth. The female's right arm is in a slightly elevated position, and appears to be holding some object. Beneath the hand-held object a line of boulders extends straight downward to a second line which underlies the seated female. A small rectangular boulder outline was located 23 metres southeast of the effigy. These boulder outlines lie at the base of the valley slope on an old flood plain, 120 metres east of a permanent flowing creek. A small clone of aspen (Populus tremuloides) and assorted native fruit trees are located immediately to the west of the female's head at the edge of the floodplain.

4.5.2.2 Human Effigies Outside Saskatchewan

The 13 human effigies beyond Saskatchewan's borders have been identified by the individual authors (Table 9) as pertaining to many cultural phenomena. Many relate to circumstances similar to the Dewdney Avenue figure or to male outlines commemorating "Old Man's" presence in this environment:

> (Old Man) made the Milk River (the Teton) and crossed it and being tired, went up on a little hill and lay down to rest. As he lay on his back, stretched out on the ground, with arms extended, he marked himself out with stones, - the shape of his body, head, legs, arms, and everything. There you can see those rocks today (Grinnell 1962b:137).

Old Man, the Trickster, was also known as "Napi" among the Blackfoot (Grinnell 1969:47), "Wesakachak" among the Cree (Beardy 1969:62), "Nanibush" among the Ojibwa (Steinbring 1970:247), "Coyote" among the Kootenai and Columbia River tribes (Clark 1969:26, Underhill 1953:255), and "Iktomi" among the Sioux (Hassrick 1964:155-156). This powerful and mischievous god was seen as a benevolent deity that named all animals, created rivers, and acted as a guardian for men and animals threatened by malevolent deities or monsters. Trickster tales were often told around evening campfires as folklore and as testimonies as to how Indians should behave toward one another (Underhill 1953:255).

The illustrations from the other available human effigies located on the northern Great Plains are represented in the List of Figures section. Readers are directed to the original descriptions provided by the original authors (see references in Table 9), as repetition of their analyses is too voluminous to be presented here. The illustrations were provided to exhibit the variability of depiction, and were presented on Map 6 to show their dispersal across the Plains. Figures 87, 88, and 93 were interpreted by me to be human effigies, contrary to the analyses presented for the second two by the original authors. The inclusion of the latter figures as human effigies was based on their similarity to the other effigies presented in this category.

4.6. Class IV. Geometrics

This classification is designed to incorporate those boulder alignments which are definite products of human manufacture, but do not illustrate distinct form patterns. In this research geometrics include those boulder monuments which may symbolize a particular meaning to clansmen or to adept observers. Only the Saskatchewan geometrics were personally observed.

4.6.1 Saskatchewan Geometrics DkOj-2 (Fig. 100); DgNf-5 (Fig. 102); DkOe-2 (Fig. 103)

Geometrics, representing assumed defense shelters, mosaics, vision-quest sites, quarry sites, and war lodges are scattered throughout the Northwestern Great Plains. Only one each of the last three examples are known in Saskatchewan. Of the three, vision quest sites are the most prolific type encountered, with sites identified across the western portion of the larger study area. While other geometrics have been identified (see Table 11, and Map 6), only the Saskatchewan sites have been classified into assumed subclasses.

4.6.1.1 Geometric Subclass A, Site DkOj-2 (Fig. 100)

Site DkOj-2 is located on a height of land within the Cypress Hills escarpment. The glaciated hills resemble mountain foothills with deep, narrow coulees, and shallow surface soils; and are:

> rolling areas in which ground moraine, with strong swell and swale ... though there are local till and outwash plains (Richards 1969:41).

The site consists of an inverted 'U' shaped configuration 9.3 metres wide and 11 metres long, constructed of boulders and heaped earth a half a metre in height. Two boulder lines extend out from the tips of the 'U', and a central boulder line (between the other two lines) begins half way between the two tips and extends an equal length. A large dolomite boulder (0.93 m long x 0.79 m wide x 0.57 m high) is situated between the centre and west lines at the opening of the 'U'. A small concentration of fire-cracked rock is located 8.57 metres west of the centre of the top of the 'U'. A habitation camp once existed 2.5 kilometres east of the site, until that area was cultivated approximately 30 years ago (R. Lawrence, personal communication 1980). The structure occupies a height of land toward the eastern edge of the escarpment. A permanent creek is located 3.2 kilometres to the west.

4.6.1.2 Geometric Subclass B, Site DgNf-5 (Fig. 102)

DgNf-5 is located adjacent to a valley edge. The valley and some of the contributing coulees possess both aspen popular (Populus tremuloides) and river poplar (P. deltoides) which offer an ample supply of logs, bark, and brush. This site is located within one kilometre of DgNg-1 and DgNg-2 (previously described, a turtle effigy site and a possible dance-floor area), both of which are associated with habitation circles. As neither of these two sites are visible from DgNf-5, the chance of this feature being used during occupation at either of the other two sites is possible.

The valley below this site possesses a permanent, spring-fed, stream producing an ample water supply which has never diminished in its volume flow (D. Giles landowner, personal communication). This small stream flows south into Montana, ultimately into the Missouri River system. As such it would present a viable route toward tribes to the south who might have resided close to this water source.

4.6.1.3 Geometric Subclass C, Site DkOe-2 (Fig. 103)

DkOe-2 represents the only boulder monument in Saskatchewan constructed solely of a single boulder type. All are reddish-orange, iron-stained quartzite boulders. The boulders are elliptical and uniform in size ($\overline{x}$ = 23 cm^3). Forty-five habitation circles are located to the north, south, and east of the boulder monument, with the majority to the east, occurring up to 130 metres away. Immediately to the west the land slopes gently down to an old floodplain which is completely devoid of habitation circles, possibly indicating a spring occupation when that plain would be flooded by Bone Creek, 200 metres west of the site. This boulder monument lies within an old excavation which was dug down 24 centimetres below the surrounding prairie level. A second prehistoric excavation was located 14 metres south of the monument. Both excavations possessed an equal number of a common assortment of artifacts; however, only the north excavation possessed boulders.

4.6.1.4 Other Geometrics Out of Saskatchewan (n = 50)

A multitude of other boulder alignments exist on the Great Plains and eastern environs. Most publications list these as mosaics, geometrics, or boulder pavements. As the majority of the publications do not illustrate these features, they cannot be speculated on as to form, function, or possible tribal association. The exceptions were the Thunderbird nests discussed by Carmichael (1979). As the comparable ethnographic material is somewhat conjectural, these features are discussed in Chapter V: Speculations.

4.7 Summary

Subdividing boulder monuments into four descriptive classes permits common outline varieties to be analysed in terms of more appropriate construction attributes. By this methodology it is also possible to observe and group common site characteristics. The ability to reassign these monuments exemplifies the need for the descriptive classes and subclasses.

Class I. Medicine wheels were subdivided into four assumed subclasses:

Subclass A: Large Central Cairn
Subclass B: Large Central Cairn Encompassed
Subclass C: Small/No Central Cairn
Subclass D: Encompassed Feature

Class II. Ceremonial circles, by their size and pattern orientations, were subdivided into four assumed subclasses:

Subclass A: Circle with definite marked entrance path
Subclass B: Large Circle, Enclosed Boulder(s)
Subclass C: Enclosed Cairns
Subclass D: Enclosed Boulder Line

Class III. Effigy Figure boulder monuments in Saskatchewan portray four animal outlines and the two assumed sexes of human effigies. These subclasses are assumed to represent the possible ceremonial uses as:

Subclass IIIa. Animal Outlines -
    Turtle Outlines
    Badger Effigy
    Salamander Effigy
    Bison Effigy
Subclass IIIb. Human Effigies -
    Male Effigies
    Female Effigies

The three Saskatchewan Class IV Geometric boulder monuments were subdivided with reference to descriptions of features described by others or assumed by site observations. These subclasses consist of:

Geometric Subclass A
Geometric Subclass B
Geometric Subclass C

Other Geometrics were described in various publications for Northwestern Great Plains sites. As none of those sites were personally inspected, and in most cases were not completely described or illustrated, their assumed classifications in Table 11 (Chapter V) were in reference to published accounts.

The subclasses discussed in this chapter were devised on the basis of similar site attributes and feature similarities. When the analogies in the following chapter are reviewed in conjunction with the descriptive subclasses presented in this chapter, together with the numerous boulder monument comparisons from other plains areas, the subclasses may present a more logical format for these analyses.

CHAPTER V

HISTORICAL SPECULATIONS

5.1 Introduction

The examinations of the Northern Great Plains occupants and the classification of boulder monuments with respect to form have been presented. Now, I propose to re-examine each of the boulder monument class and subclass in comparison with "ethno-historic" (Willey 1966:482) accounts. These comparisons are attempted to propose functions for boulder monument construction.

The information used for the comparative purposes was that which seemed to describe best each subclass used. This statement does not mean to imply that other speculations or analyses by other researchers past, present, or future may be incorrect. These are speculations which I ascertained to be the most appropriate for the subclasses devised by this research.

In some instances, notably the Dewdney Avenue Human Effigy, Ceremonial Circle Subclass D, and the possible quarry site, definitions may seem to stretch speculation to the extreme. However, this "speculation stretching" may induce other researchers to examine other boulder monuments more intently; and thus contribute toward less speculative, and therefore, more accurate future analyses.

Prior to the ethno-historic accounts examinations, boulder monument dating by projectile point association is discussed. Other examinations of other cultures both on the Plains and possibly related to early Plains exploitation are added. Also, boulder monument associations/exclusions with other Plains rock art forms are examined.

For ease of interpretation, the boulder monument classes and subclasses are discussed in the same order as they are presented in the previous chapter. However, in this chapter the subclasses are named by the speculated ethno-historic analogy selected for their analysis.

5.2 Dating

The greater portion of North American archaeological relative dating is based on projectile point type seriation. From this it has been inferred that Saskatchewan has been occupied for at least 12,000 years, though the earlier dates were assumed from point styles dated elsewhere or from geological inference dating (Dyck 1983:65). It is assumed that the earliest populations dated by type seriation travelled north into a recently deglaciated landscape following migratory big-game animals. The direction is probably correct for the earliest entries, but may be incorrect for later traditions represented by different point styles.

The topic of this research assumed contemporaneity of boulder monuments with the more recent Plains prehistoric occupants, or within the past 1100 years. While other researchers have presented radiocarbon or artifact-based dates for boulder monuments in excess of this time range (see Table 10), analysis of some of their researches has shown that their dates may represent materials which were in situ prior to the construction of the overlying features. Excavations at an Alberta site revealed a buried habitation circle assumed to date to the Oxbow phase, usually dating to 3500 B.C. (Adams 1978:58-60), which lay under a surface habitation circle with:

> ... side-notched projectile points ... assigned to the Old Woman's phase which dated between A.D. 750 and A.D. 1800 (Adams 1978: 45, 58).

The thirteen dated sites listed in Table 10 were dated primarily by

TABLE 10

BOULDER MONUMENTS DATED BY ARTIFACT ASSOCIATION, RADIOCARBON, OR HISTORIC REFERENCE

Borden Reference	Common Site Name	Site Type*	Date (Source)	Reference
DkMq-2	Moose Mountain Medicine Wheel	M.W.	B.C. 800 (radiocarbon)	Kehoe & Kehoe 1979
**	Steel Medicine Wheel	M.W.	1938 A.D. (historic reference)	Dempsey 1956
DlPl-2	Wolf Child Medicine Wheel	M.W.	historic (glass beads)	ASA
DkPf-1	Many Spotted Horses Medicine Wheel	M.W.	1884 A.D. (historic reference)	ASA
DlOv-2	Grassy Lake Medicine Wheel	M.W.	200 A.D. (? chert point?)	ASA
EbOm-1	Many Island Lake Medicine Wheel	M.W.	B.C. 1000 - 1000 A.D. (Pelican Lake - side notched)	ASA
EaPe-1	Sun Dial Hill Medicine Wheel	C.C.	200 A.D. (comparable to DlOv-2)	ASA
EdPc-1	Majorville Cairn and Medicine Wheel	M.W.	B.C. 1895 (radiocarbon)	Calder 1977
EgNx-1	Hughton Medicine Wheel	C.C.	900 A.D. - 1850 A.D. (late plains pottery)	S M N H
EdOp-1	British Block Cairn	M.W.	B.C. 3500 - 1850 A.D. (Oxbow - late historic pottery)	Wormington and Forbis 1965
EhOp-1	Buffalo Bird Medicine Wheel	C.C.	B.C. 1000 - 750 A.D. (corner-notched point)	ASA
EkPf-1	Rumsey Cairn and Medicine Wheel	M.W.	200 A.D. - 1800 A.D. (associated artifacts)	ASA
48BH1302	Big Horn Medicine Wheel	M.W.	1760 A.D. (dendrochronology)	Grey 1963

Legend:
* - classification by this research
MW - medicine wheel
CC - ceremonial circle
SMNH - Saskatchewan Museum of Natural History, excavated materials
** - no Borden number noted in Archaelogical Survey of Alberta files
ASA - Archaeological Survey of Alberta

artifact associations, historic reference, radiocarbon analysis, and dendrochronology. Of the four types of dating, the historic reference can be viewed as the single accurate method. Dendrochronology is usually accurate; however, Wilson (1981:342-344) points out that the tree fragments used by Grey (1963) may record late "treasure hunting vandalism" that occurred at the Big Horn site in the 1890s (Wilson 1981:344). As some of the problems possibly associated with the radiocarbon dates achieved at Majorville and Moose Mountain have been discussed at length elsewhere, there is need only to add here that both of those dates appear to be somewhat questionable.

The dating of these on- and above-surface sites by artifact association is the most problematic or most questionable method. This problem was first stated by Wormington and Forbis (1965:122-123) when they noted an admixture of Oxbow and McKean projectile points together with pottery occurring throughout a deposit. Similarly, pottery and Avonlea points were noted in the shallow deposits at the Hughton Medicine Wheel Site (Saskatchewan Museum of Natural History, unpublished 1968 field notes). Archaeological observations of excavated sites usually evidence the most recent artifacts in the upper soil layers and the older artifacts toward the bottom of the excavation. When an unsorted assemblage of projectile points occurs a number of possibilities may be considered: 1) the site is as old as the earliest projectile point located, 2) the mixture of artifacts represents offerings of many types collected and deposited over a relatively short period of time (Wormington and Forbis 1965:124-125), or 3) the artifacts represent mixing by burrowing rodents.

Coupled with the problem of stratigraphy is the dating by projectile point association. For each projectile point type there is usually a range of time occurrence. Does one select the earliest time, the most recent time, or an average of the two? Additionally, what is the spatial distance between the projectile point type site and the boulder monument site? Is there a more local correlative dated site? And to reiterate, how can one be certain that an early point wasn't used as an offering at one of these shallow stratigraphy sites?

The preceding problems were some which I encountered early in my research. For those reasons I attempted lichenometric dating as a possible means to date the single-tiered boulder constructions - since most of the cairn configurations had possibly been disturbed prehistorically by devotees, or historically by early archaeologists or treasure-seeking pot-hunters. While the present lichenometry problems seem to outweigh the advantages of this form of dating, the late clustering of dates also might infer that in some cases the outlines were late additions onto earlier constructed cairns. If so, surface-deposited artifacts may witness only offerings by recent artifact collectors.

As no buried boulder monuments have been located on the northwestern Great Plains, the more recent construction times are reasonable since all known boulder monuments are only partially enclosed in the soil matrix, possibly denoting less antiquity than other buried components.

5.3 Entry Speculations

The routes of plains access by various tribes in historic times are of interest to this research's analysis. Linguistically, the earliest recorded migrants were possibly Algonkians (Blackfoot and

Arapaho) from the eastern woodlands and Athapaskans moving south from northern Canada. Ethnohistorically, Kootenayans may have entered from the west through intermontane passes, the Shoshoni from southwestern intermontane areas, Siouan bands from the southeast, and Caddonans from the south.

The traditional impression of an empty plains region awaiting peripheral occupants (Kroeber 1952:257) is no longer accepted, as the archaeology record evidences continuous occupation (cf. Dyck 1983). If the plains were unoccupied the Athapaskan migrants of the early 1300s (Welsh et al. 1984:9) should have occupied this area rather than migrating to northwestern Wyoming and the Black Hills of the Dakotas (Nye 1962:vii). However, it is possible that the earlier Blackfoot occupants resisted the Athapaskans, perhaps accounting for the division of the Sarsi from the Kiowa-Apache (Terrell 1975:25-26). In such an instance the Sarsi may have been able to co-exist with newer exploiters, while the Kiowa-Apache vacated the area. This situation may explain the Sarsi's occupation of Alberta's northernmost plains as a Blackfoot ally, and the woodland Cree's early Sarsi acquaintance (cf. Coues 1897: 532).

While former travel and technological modes may have been abandoned, cultural entities should have been adapted to the new environment. Material cultural aspects, as defined by Quimby (1968:29), involve energy potentials extracted from the habitat (Cohen 1968:282). Therefore, migrants must change culturally in a new environment. This change might involve cultural blending between and among migrants emerging from different directions toward what is sometimes referred to as a 'Plains-Identity.' In this model the later Plains Indians might all adopt certain features from each other's cultures and blend them into more homogeneous cultures. Mandelbaum (1979:24) notes that the Cree traded with "Slaves and Eskimo"; and that the Assiniboine, Monsoni, Ojibwa, eastern Algonkians, Dakota, Athapaskans, and Blackfoot "occasionally camped with and married into the bands of the Cree" (1979:34). In these exchanges, men and women might be viewed both as the vehicle for genetic exchange and the movement of styles, ceremonies, and languages between tribes.

5.4 Distribution of Other Effigy Symbols

Pictographs and petroglyphs are common in the areas peripheral to the plains region; however, petroglyphs are the major depiction found on selected plains sites where rock outcroppings or glacial erratics are located. The only boulder features sometimes found in conjunction with plains petroglyphs are habitation circles; boulder monuments seem to be almost non-existent in the immediate vicinities. One exception is the location of a vision quest site (a boulder monument construction), together with petroglyphs and drive line cairns (economic rather than ceremonial-designed boulder configurations) at DkPj-1, the Head-Smashed-In Buffalo Jump in Alberta (Brink *et al*. 1985:262). Additionally, Uyttenhager's observation of a "... large white boulder ..." with "... a face and numerous other marks incised in it" (McCorquodale 1961) at the Minton Turtle Effigy may propose anomalies rather than common site occurrences.

Steinbring's thesis of boulder monument occurrence at sites away from pictograph sites as representing a continuation of style in a different medium (Steinbring 1980:245) holds true. Alternatively, his thesis of boulder monuments, located along the Whiteshell River, being repeated at various plains sites (Steinbring 1980:327) is not completely acceptable as there are no medicine wheels, Matoki lodge structures, bisected circles, vision quest structures, bison effigies, or salamander effigies in Manitoba. Granted, there are animal effigies along the Whiteshell River; however, the differences in animals depicted should be indicative of unrelated occurrences. The occurrence of other different figures on the plains sites should indicate either later initiation of ceremonies adapted to a new environment, or the invention of new symbols as a result of culture amalgamation.

The Minnesota and Iowa boulder monument concentrations also occur away from pictograph and petroglyph sites. The lack of recorded sites along rivers in North Dakota may be due to their destruction by intense agricultural practices, the Garrison Dam project (at least one recorded site; see Libby 1910), or a lack of interested recorders during the early settlement years.

A review of pictographs and petroglyphs both in the areas peripheral to the plains and on the plains proper revealed some Minnesota figures with designs similar to Medicine Wheels (cf. Winchell 1911: Pl. V No. 4, P. Vl No. 10, Pl. VIII Nos. 1-4 [3], Pl. IX No. 2) which have been attributed to "western branches of the Dakota" (Winchell 1911:560). Although one other pictograph, near Rocky Dell in Oklahoma, seems reminiscent of the Big Horn Medicine Wheel (cf. Conrad 1963:61, Figure 7 upper left plate), the absence of medicine wheels south of South Dakota should dispel any possibility of similar purpose or meaning between these depictions.

While some boulder monuments have been noted near North Bay in Ontario (Tyyskä and Burns 1973), the geographical distance and dearth of these depictions between these sites and the eastern plains locality at Whiteshell in Manitoba, may indicate a disconformity of cultures or purpose. The human and animal rock outlines in southern California (Setzler 1952) should represent a similar disconformity as there are no reported effigy monuments between that area and the central or northwestern Plains.

5.5 Relations to Adena, Hopewell, and Middle Missouri

The effigy mounds of Minnesota and the Adena and Hopewell mounds of the upper Mississippi River area share some design similarities with plains boulder monument animal outlines. The differences in construction materials, sizes, and earthmound purposes as burial mounds (Stoltman 1979:127) should distinguish these as regional cultural disconformities.

The Hopewell culture, 100 B.C. to A.D. 200, appears to have maintained trading networks across the Great Plains as far west as the Rocky Mountains (Prufer 1965:132). While such trade may have influenced their trading partners' style motifs, the absence of earthern effigy mounds on the Great Plains may suggest that there was little or no Hopewell burial ceremonial influence in this area. Also, boulder monuments are usually found singularly, whereas effigy mounds are "... more commonly found in groups of a dozen or more ..." (Ritzenthaler 1976:2).

Wedel (1959:564-566) proposed a possibility that the Middle Missouri Central Plains Tradition (ca. A.D. 1000) evolved from Middle Mississippi (approximately A.D. 900) influences, based on generalities in ceramics and house styles. As a contemporaneous culture with Initial and Extended Middle Missouri but with dissimilarities in geographical distributions, architecture, village plans, burial customs, and several artifact types (Lehmer 1971:107), the earthlodge peoples are only a possible reflection of the late state of Mississippian dispersal. The Initial and Extended Middle Missouri peoples were probably Siouan speakers, and resemble similar tribes in southern Minnesota and northern Iowa (Lehmer 1971:100, 120, 126). Additionally, the Arikara as a Post Contact Coalescent Variant of Middle Missouri possibly represent a late Caddoan migration and adoption of earthlodge village traditions (cf. Lehmer 1971:136). The northern earthlodge people's burial patterns are poorly known (cf. Lehmer 1971). Even the earliest migrants into the middle Missouri may possibly be viewed as peripheral to Mississippian traditions (Willey 1966:320, 338).

Based on 19 groups of crania, (a total of 942 individuals), Ossenberg's 1974 study illustrated that the Minnesota and Illinois Woodland samples were dissimilar to one another, although the Minnesota series:

> ... was morphologically closer to local prehistoric groups and to historic plains tribes than it (was) to the Hopewell series (Buikstra 1979:228-229).

Consequently, there seems to be sufficient evidence to dispel any notion that Adena, Hopewell, or the Middle Missouri cultures were ancestral to or the basis from which Plains boulder monuments evolved. Even the analysis of human burials discounts any possibility of a migration of those peoples into Minnesota as possible originators of the later boulder designs. Finally, the near lack of animal effigies in the vicinity of areas occupied by the late-date descendants of the Middle Missouri cultures yields them as unlikely boulder monument constructors.

5.6 Possibilities of Recent Dakota Involvement

During the early nineteenth century, the Dakota insisted that their original homeland was northwest of their Minnesota location (Winchell 1911:XII). Additionally, in 1804 Lewis and Clark recorded that the various Dakota bands claimed a territory from the Mississippi through to the Montana Rockies and back to the confluence of the Des Moines River with the Mississippi (Thwaites 1969:98-99). While portions of this area were probably disputed with other tribes, the territory suggests the Dakota's exploitation range.

The Wiciyela or Middle Dakota were associated with the Minnesota district (Howard 1966:11). Originally, all Dakota probably shared a common language and culture. While separation from "the original seven council fires" may have induced linguistic differences and the adoption of other peoples' cultures (Howard 1966:3), their own cultures and ceremonies should have maintained certain basic elements. The original proximity of the Yankton-Yanktonai in Minnesota with Algonkians, who were obtaining trade goods from English fur traders, may have induced the Assiniboines to ally themselves with a previous adversary following their dispute with their former tribesmen (cf. Glover 1962:164).

The Assiniboine were first referred to in 1640 in the Jesuit Relations, although no detail of their location or relationship to the Yankton was recorded (Thwaites 1959:231). Ray suggests that the Assiniboine may have maintained some peaceful relations with the Yankton as late as 1670, but their relationships may have deteriorated in the latter part of the seventeenth century due to fur trade pressures (Ray 1974:6). From 1660 to 1731 the Assiniboine occupied an area from Lake Superior in Ontario to the Touchwood Hills in Saskatchewan (Ray

1974:6-12). During most of this time Lake of the Woods was referred to as "Lac des Assiniboils" (Ray 1974:11), possibly indicating continuous occupation of that region. At the same time the Middle Dakota moved west out of Minnesota to the east side of the Missouri River:

> In the process of moving the group divided. The Yankton proper moved southwest to what is now southeastern South Dakota and nearby parts of Iowa and Minnesota ... The Yanktonai or "Little Yankton" occupied the area north of this in southern North Dakota ... (Howard 1966:11).

Human and animal effigies along the eastern and southeastern portions of the Northwestern Great Plains seem to occur mainly in the regions adopted by the Assiniboine and the Yankton-Yanktonai, in the vicinity of Lake of the Woods at Whiteshell in Manitoba; and along the Missouri River in southern North Dakota, northern South Dakota, and the adjoining portions of Minnesota and Iowa. The near absence of effigies in North Dakota presents a problem of boulder monument route dispersal. For this reason dispersal across North Dakota was extrapolated, as I was able to locate only a minimum amount of published material concerning these features (cf. Libby 1910:685-687; Anonymous 1938:19). The complete absence of reports of these features between the Garrison Dam in North Dakota and southern Saskatchewan may attest a discontinuity of Yankton-Yanktonai exploitation range, destruction or submergence through construction of the Garrison Dam, early agriculture removal, or boulder monument construction in Saskatchewan by a different tribe. If the Yankton-effigy association is correct, the presence of a turtle effigy (cf. Gilmore 1932) in Nebraska might be viewed as evidence of the Yankton's most southerly extension.

5.7 Medicine Wheel Analogies

The following ethnographic references are those which seem best to qualify each of the subclasses defined. The added speculations are used to link the different sources to each subclass and to add new possible dimensions of analyses.

In this analysis, the term 'subclass' is used as a theoretical construct based on a combination of presumed use and form from both site observations and ethnographic analogy. While some of the subclasses may appear empirical, these theories are presented to indicate the range of possibilities for different medicine wheel patterns. Future research may expand or narrow the range of varieties, but:

> Unless anthropology is to interest itself mainly in the unique, exotic, and nonrecurrent particulars, it is necessary that formulations be attempted no matter how tentative they might be. It is formulations that will enable us to state new kinds of problems and to direct attention to new kinds of data which have been slighted in the past. Fact-collecting of itself is insufficient scientific procedure; facts exist only as they are related to theories, and theories are not destroyed by facts - they are replaced by new theories which better explain the facts (Steward 1955:209).

5.7.1 Subclass IA

Since a burial was located at DiMv-2 (Montgomery 1908:30, Capes 1963:118), it is possible that all of these sites may possess burials or burial goods. The central cairn of DiMv-2 contained a corpse. In 1980 the scene of the destroyed Canuck Medicine Wheel (DhOb-2) was extensively surveyed both on the cultivated site area and at the resultant rockpile. Neither location revealed human skeletal elements, lithic materials, or suspected grade goods. As the site had been seeded to crop, permission to test-excavate could not be obtained from the landowner. The Jelly Ranch Medicine Wheel (EdNg-1) was partially disturbed by gravel testing operations in 1977. Though a thorough examination of the site failed to reveal human skeletal remains or grave goods, one of the gravel truck operators reported "hearing of someone (?)

taking some bones from the rock pile" (personal communication). Further investigation with the landowner and the gravel contractor failed to yield additional information. Feature 1 at the Oxbow Medicine Wheel site (DgMn-3) was reported by the landowner to have possessed some "bones and beads" (J. Mellom, personal communication). These materials were excavated by the landowner and his cousin in 1935. When asked if they could be inspected, the informant replied that they had been "taken back to the States" by his cousin.

Though the preceding information is sketchy, a sufficient amount exists to indicate a possible burial function for this type of medicine wheel. A description of a Blackfoot burial lodge seems to be comparable to this feature:

> ... the death of an important leader ... was coupled with an elaborate ceremony of burial in a death lodge ... After ... rocks were piled in lines extending outward from the death lodge in the four cardinal directions. Each pile of rocks represented one of the departed leader's coups (Ewers 1955:284).

Theoretically, if the leader was elderly or very prestigeous, there might also have been many rock lines indicating a great number of coups.

Important Blackfoot chiefs were buried either on the open prairie or on high buttes where their graves were marked with stones:

> Apparently the more important a chief was the more elaborate was the arrangement of stones. The grave of Little-Medicine-Pipe is quite elaborate. Two concentric circles of stones mark the place of the tipi. Radiating out from the outer circle are seven long lines of stones at regular intervals like the spokes of a wheel. Each line is said to denote some successful expedition of this man. The line running to the east terminates in a rough square of stones, indicating the direction from which the man had originally come (Kidd 1937:62).

For example, the design on another Blackfoot's tipi, that of Bear Chief, illustrated five triangles, the apex of each triangle toward the top of the lodge (*cf*. Lowie 1963:110, g). The design inferred that the individual had killed five Flathead Indians. The interspace between the triangles were shown as relatively straight lines. If upon his burial his coups were counted by the method previously discussed, Bear Chief's burial lodge may have had five boulder lines radiating away from his burial cairn.

Most other tribes placed their dead on scaffolds or in trees (Morgan 1959:102). The Ojibwa, Cree, and Chippewa were observed to bury their dead directly in the ground covered with:

> ... a small dirt mound which is overlain with planks, poles,or birch bark (Carter 1973:63).

The Mandan of the Missouri River placed the putrified skulls of the corpses in circular alignments with other human skulls, after the remaining bones had been buried (cf. McCracken 1959:99, Thomas and Ronnefeldt 1976:210).

5.7.2 Subclass IB

These medicine wheels have radiating spokes which bisect a boulder circle. In both cases some or all of the spokes terminate at cairns. My personal rejection of the astro-archaeological theory proposed for DkMq-2 led me to look for ethnological accounts which, through their descriptions of certain events or phenomena, could be viewed as other possible explanations.

My examination of a photograph of a birch bark scroll brought into SMNH in 1968 revealed a design similar to both DkMq-2 and DgMn-3(3). The scroll orginated in the mixed parkland region in the vicinity of the Assiniboine River in Saskatchewan. The design (Fig. 33) shows a figure resembling a tipi with four radiating lines, along which animals (deer?) appear to be located. The illustration seems to indicate a divination practise where a medicine lodge has been established, and directions leading toward game animals have been defined. Medicine lodges are documented among the Ojibwa, late residents of that area of southeastern Saskatchewan (Howard 1977:29-30). John Tanner related a dream where a spirit appeared in his lodge and pointed out two directions where game could be located (James 1830:180-183). Tanner further narrates that Chippewa medicine hunting consists of:

> ... drawing an animal on its scapular bone ... (and) ... cast the bone ... into the fire ... this fulfils all those important ends (James 1830:184).

Other subarctic Indians used scapula divination by:

> Fixed in a cleft stick by the joint end, the shoulder blade is held to the fire, and on it brown marks appear ... The interpretation of the various dots and lines ... caused by the heat varies from individual to individual. A large spot in the middle usually indicates starvation, for it means "stay in camp, there are no paths to follow." Thin lines with a blob at the end indicate that there are caribou not too far away, or perhaps other Indians who will share the food they have ... from the scorch marks he will divine the absence or presence of caribou and the directions in which the hunt should be made (Webber 1964:40-41).

The Saulteaux (Plains Ojibwa) beat on an animal's scapula, then interpreted the cracks (Mandelbaum 1979:177).

The possibility of multiple uses for medicine wheels (cf. Wilson 1981:337-338) may be reflected in these features. The Moose Mountain Wheel (DkMq-2), with radiating arms terminating at cairns ("blobs") might represent a double use where divination occurred at special ceremonial seasons. The bisection of the inner circle (a lodge remnant) by radiating lines (extentions from a central hearth) to exterior points (herds) seems relatively well defined. The lack of cairns at the ends of four lines at DgMn-3(3) might represent directions to individual animals, while a line terminating in a small boulder circle may indicate the direction to other individuals with food to share.

5.7.3 Subclass IC

All of these medicine wheels are close to stone circle sites. Possibly this peripheral placement of the feature represents some phenomena that occurred at the habitation site or within a short time of its occupation. These medicine wheels might have been constructed to direct others' attention to some phenomena by a specific pattern which could not be readily observable by viewing just the habitation camp.

These features may best define memorials as defined by Dempsey (1956), denoting an important or well-respected individual. As some plains groups did not possess totems to indicate band or family association, some other form of affiliation, particularly to denote a deceased's memorial, could have been devised. As most plains camps were organized by band affiliation (cf. Arapaho - Hilger 1952:192, 230; Blackfoot - Ewers 1955:146; Teton Dakota - Howard 1966:20-22; Assiniboine - Rodnick 1937:410-411; Cree - Oliver 1962:26; Plains Ojibwa - Howard 1977:19), the location of each individual's lodge in relation to the band leader's was pre-established:

> The tribal circle, each segment composed of a clan, gens, or band, make a living picture of tribal organization and responsibilities (Hodge 1907:198).

Additionally, Hilger notes for the Northern Arapaho:

> when the people were moving and they had nearly reached their destination ... the chiefs went ahead to the place at which we were to camp ... Once they had decided where the entrance to the circle was to be, we all knew where we were to place our tipis. Related families always had their tipis close together (1952:192).

Also, Kidd (1937:118) notes for the Blackfoot:

> In the Sun Dance camp, the tipis were pitched in a circle around

> the Sun Lodge, each band having its hereditary position with relation to all the other bands.

Kroeber (1902:8) notes that Arapaho band members always occupied one area of the camp circle. These camp alignments may have been altered slightly over the years to accommodate the loss of families through death or transfer to other bands; however, the band organization of camps would have been readily recognizable to tribe members. As a comparison, Seminole camp arrangements over the 12 year period 1936 to 1948 remained fairly constant with reference to the central lodge and to other band locations (cf. Capron 1953:180-181). For plains tribes only the Crow Indians appear to have lacked individual tenting positions within the camp circle (Lowie 1912:186).

A camping pattern is assumed to represent these medicine wheels, where intersecting lines or lines articulating with a representative camp circle may suggest a band leader's or a specific tribe's camping orientation. These monuments were supposedly erected where a leader died, not where he was buried (Dempsey 1956:177); hence the lack of associated habitation rings away from the ends of the radiating spokes, but within the general proximity of the memorial. The lack of a designated central area at DgNf-3 and ElOd-2 may be similar to an illustration of an 1870 Cree encampment drawn by Fine Day, in which 1600 lodges representing four bands amalgamated (cf. Mandelbaum 1979:371, Fig. 31). The four ring clusters are arranged around a central open area. The four clusters are represented by concentrations of rings only at specific locations around core areas. A description of a Blackfoot encampment supports that pattern:

> In the circle camp I counted three hundred and fifty lodges - thirty of them were Painted teepees with symbolic decorations. They belonged to the head men of different bands and were

pitched in prominent places on the inner circles (McClintock 1923:259).

5.7.4 Subclass ID

These medicine wheels all possess a boulder circle completely encompassing all of the radiating spokes. EdPc-1 and 48BH302 possess large central cairns, a feature absent at EePi-2 and 39HD22. However, EePi-2 and 39HD22 conform quite closely to a Minnesota petroglyph figure (cf. Winchell 1911:Pl.VI#10). The two other configurations seem to be similar representations of prehistoric garden designs from Wisconsin (cf. Riley, Moffat, and Freimuth 1981:104, Fig. 1).

It is possible that some medicine wheel outlines served "to insure the fertility and increase of the bison herds" (Calder 1977: 208). As fertility symbols the Bighorn (48BH302) and Majorville EdPc-1) sites somewhat resemble the ridged fields of Michigan and Wisconsin, which were:

> associated with the Lake Winnebago Focus manifestations of the Oneta Aspect, dating to the period from about A.D. 1000-1300 (Peske 1966:193-195).

If the Blackfoot did arrive on the northwestern plains as early as suggested by the Apache displacement (Wedel 1961:100), they may have maintained this symbolism. Also if the Blackfoot, as Algonkian speakers, had originated in the Michigan-Wisconsin-Minnesota area, their early observations of ridged garden fields might have promoted the outline use as a fertility symbol. The garden sites in the east were:

> ... heaps of rocks interspaced with the garden beds, which were apparently composed of materials that the prehistoric farmers had cleared from their fields (Riley, Moffat, and Friemuth 1981: 104-105).

This conjectural discussion does not mean to infer that the Blackfoot definitely migrated from the Michigan or Wisconsin woodlands. However,

> War and travel among foreign tribes were the two most thrilling adventures open to Blackfoot men. Since there could not be "many remarkable Warriors and Hunters, a few mix with other tribes and learn their languages, and become acquainted with their countries and mode of hunting .... This wandering off to live among other tribes had more far-reaching effects than might at first be apparent. These "students ... must have been a powerful force in leveling the culture of the Plains area;" so that their permanent influence was undoubtedly of profound significance (Kidd 1937:41).

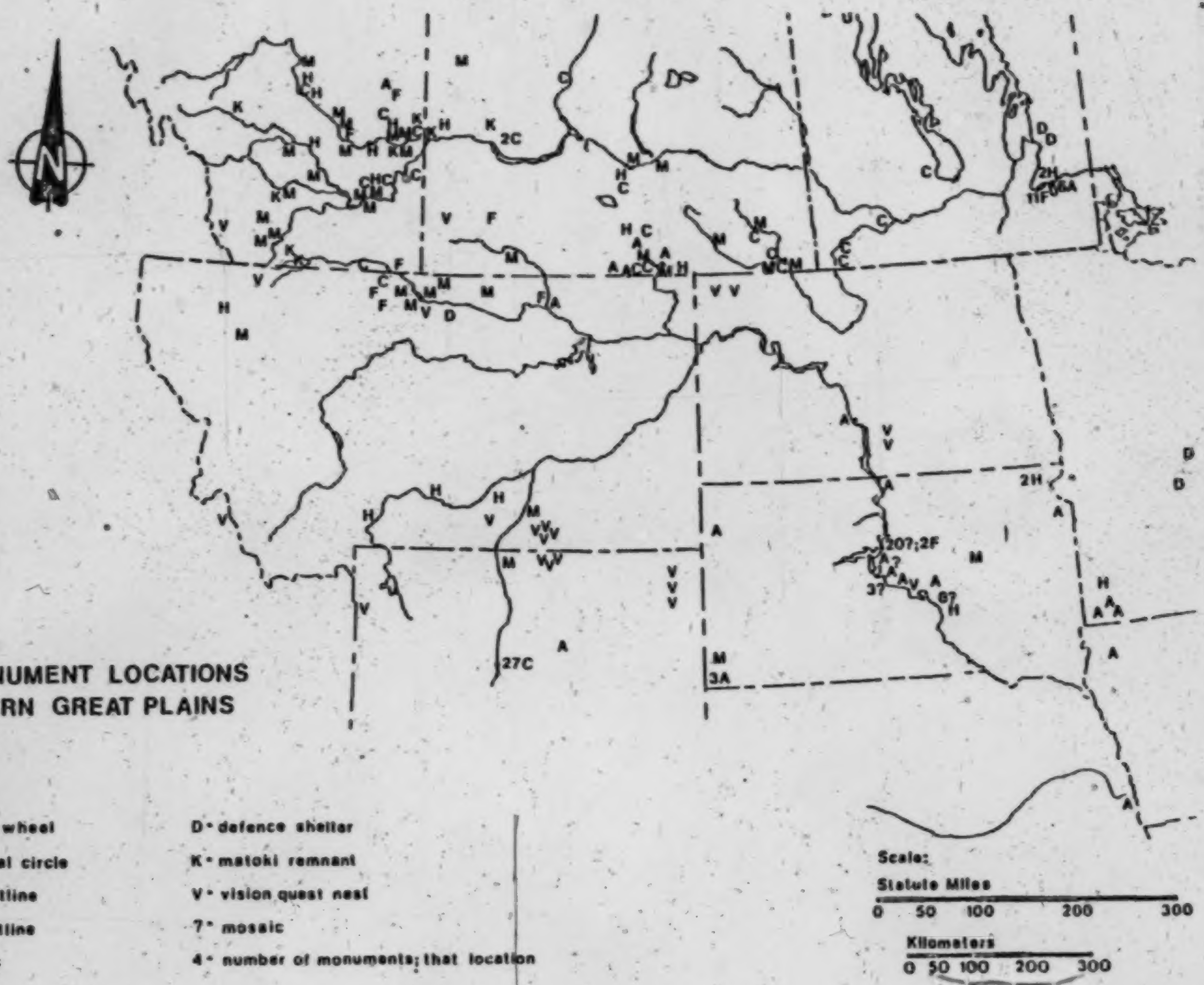
As the hills in the immediate vicinity of EdPc-1 are currently incapable of supporting any vegetation other than short grass and cactus (B. Byrne, personal communication), the presence of early deposited buffalo stones in the central cairn (Calder 1977:208) may suggest a site use of enhancing continued bison fertility. The Bighorn site also could have possibly been a bison fertility symbol, as the brief summer and high altitude would have been prohibitive as a garden site (cf. Simms 1903a; Wilson 1981). The lack of a central cairn at EdPi-2 and 39HD22 for buffalo stone offerings, and the reduced symbol sizes, might suggest that these were sites known to individuals rather than being communal ceremonial sites.

5.8 Ceremonial Circle Analogies

5.8.1 Subclass IIA

These Ceremonial Circles, here assumed to be Matoki lodges, all have a definite entrance and central boulder cairn; and all are located prominently on the landscape. Collectively these sites seem to resemble miniature buffalo pounds. Thus, they may represent something like a Blackfoot Woman's buffalo lodge:

> There was a woman's society among the Blood and Northern Blackfoot tribes which was unknown among the Piegans. Its members were wives of the most highly respected men in their tribes. Prior to the sun dance in summer, members of this Matoki Society built a ceremonial lodge which resembled a buffalo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Map 6

BOULDER MONUMENT LOCATIONS
on the NORTHERN GREAT PLAINS

Legend:

M - medicine wheel
C - ceremonial circle
A - animal outline
H - human outline
F - geometric
D - defence shelter
K - matoki remnant
V - vision quest nest
7 - mosaic
4 - number of monuments; that location

> corral, and on the third day of their four-day ritual reenacted the drive of the buffalo into the corral (Ewers 1958:106).

The specific construction features of a Matoki Lodge are:

> A tipi pole is set up in the centre ... A number of travois are set up in a circle around this pole and joined together by tipi poles set at the top ... On the sides and over the top are stretched tipi covers. At the bottom they are weighted down with stones (Wissler 1913:430).

For the Cree style of pound a:

> ... circular area thirty to forty feet in diameter was cleared ... a single tree was left standing in the centre ... (from the) ... entrance ... a runway leading into the pound was built ... The chute which guided the herds into the pound was extended obliquely from each side of the entrance (Mandelbaum 1979:54).

This pound method of bison procurement was used by the Northern Blackfoot, Assiniboine, Plains Cree, and Cheyenne (Mandelbaum 1979:330; Lowie 1963:15, Figure 3).

The Saskatchewan replications oh a smaller scale, on the local secondary heights of land, suggest representations of the Matoki lodges described, which were constructed in favourable camping locations. The absence of habitation circles at EgNx-1 may suggest a late nineteenth century ceremonial occurrence, or a summer occupation when lodges were held in place with wooden or bone pegs. The presence of the boulder outline to hold the Matoki lodge covers in place could represent a 'traditional' method as opposed to a 'functional' method. The placement of a boulder cairn centrally could have been to represent the central tree or to support the central pole described by Wissler on a treeless prairie landscape. The boulder chute (deadmen) also may have been a traditional depiction in place of sticks and bush lines (two other commodities uncommon on the prairie). The Alberta example at EaPe-1 (Fig. 42) may represent either a variation on a theme, regarding the double encompassing boulder circles; or a second celebration at a former enactment site. The extreme disturbance at EdOp-1 (Fig. 39) is assumed to be the reason for the irregular chute depiction on the east side of the feature. The two clusters of boulders to the left and right of the peripheral surround may suggest that the:

> entrance [was] to the east ... where two sturdy trees [were located] (Mandelbaum 1979:54).

5.8.2 Subclass IIB

Subclass IIB Ceremonial Circles seem to reflect amphitheatre functions as proposed by an Ojibwa meeting area where:

> ... the ceremony (was) inside a structure cleared of bush and grass, then a circle of pine boughs, some 40 feet in diameter and 2 or 3 feet high had been formed.(Bushnell 1905:69).

In the absence of bush and pine boughs it is reasonable to assume that boulders cleared away from a central area could have been placed at the edge, possibly to mark the assembly area. These assemblies were annual events where an elder spoke of their:

> blessings and misfortunes since they had met during the previous autumn; of the friends who had died in the interval; then he expressed his desire and hope that all present might come together again (Bushnell 1905:71).

A large feast, which was prepared a little distance from the assembly area, was brought to the gathering place following the elder's speech (Bushnell 1905:72).

At all three of the Saskatchewan sites listed for this subclass, stone habitation circles are located at some distance from the enlarged circle. The difference in diameter described by Bushnell is assumed to be representative of a small band. The location of EaNh-7 (the largest diameter ceremonial circle) is on the eastern edge of the Missouri Coteau. Traditionally, this site was referred to as "ceremonial dancing grounds" (Hind 1971 I:335). As a traditional ceremonial ground for plains tribes composed of numerous bands, a larger diameter area would have been required to accommodate a larger audience. As an alternative, some Indian graves are described which match these configurations. The proximity to habitation circles may rule out this later hypothesis, as some Plains Indians believed that if graves were placed in a location separated from the village by water, the deceased's ghosts would be unable to return to disturb the living (Hall 1976:361). Future test excavations will be required to confirm which interpretation is the most suitable.

The Alonsa Ceremonial Circle (Table 7; Fig. 50) as an oval structure may suggest tribal identity, as the Crow set their lodges in an "elliptical plan" (Campbell 1927:98; Fig. 6,f). As the lodges were elliptical, one may assume that an assemblage area for a multitude would possibly follow a floor plan similar to the lodge outline, thereby permitting future observers to identify the structure and its purpose.

In summary, seven of these circles possess some form of central platform. The other four (DjMr-1 and DkLw-18 and EeNu-1a & b) may have possessed elevations which were central standing platforms for a speaker. The absence of habitation circles directly associated with any of these enlarged circles should aid in the support of the previous comparisons to denote special congregation areas set off from the common, living area.

5.8.3 Subclass IIC

The central cairn aspect was the attributing factor in devising this subclass of Ceremonial Circles. The great amount of scattered boulders with a remnant arc around a slight depression at DlNf-1 (Fig. 52) seemed to indicate the possible previous existence of a cairn. The original test excavations at FbNp-2 failed to reveal anything beyond the central cairn; however, there were sufficient materials within one edge of the cairn to suggest that it may have served as a burial site (T. F. Kehoe, personal communication). Whether the cairns were erected over a period of time or in a single construction stage is unknown. Other stone cairns have been raised over long periods of time by adding token offerings (Malouf 1962:3; Squier and Davis 1973:184-185). The Pueblo Indians of the Southwest piled boulders on mesas to "... get rid of fatigue or an ailment" (Parsons 1939:460). Assiniboine Indians were noted in 1858 to make pilgrimages to a rock pile (in present southern Saskatchewan) which was noted as a landmark by historic explorers (Hind 1971 I:307). These piles of rock were noted by J. N. Nicolette in Minnesota, where he observed in 1838 that:

> The Sioux take advantage of these loose materials to erect signals on the most elevated spots, or to designate the place ... where some exhausted hunter has died on the prairies, and desires to be buried in a more prominent situation; or they amuse themselves in shaping these into fantastic figures. They give names to these localities, which serve as landmarks in a country where there are no other geographical beacons (cited in Winchell 1911: 107).

As an alternative, these structures might represent burials. Payepot's (English spelling: Piapot) 1908 grave site was described as:

> ... they opened a grave not more than six inches deep. In it they placed the coffin. Around the coffin and over it they placed stones. And they marked out a large circle beyond it with field stones (Watetch 1959:22).

Additionally, the Blackfoot have been noted to cover a corpse inside a tipi with rocks prior to sealing the edge and abandoning the site (Ewers 1955:284). If the lodge edges were held in place by boulders, the present-day remnants would reveal a cairn surrounded by a ring of boulders.

5.8.4 Subclass IID

This Ceremonial Circle is an anomaly among the Saskatchewan boulder monuments. Additionally, no other large circle with similar internal features or external site attributes has been reported in any publication for any Great Plains district. As such DgNg-2 (Fig. 59) is the most enigmatic ceremonial circle studied.

While it is an anomaly, the perimeter resembles the elliptical Atsina sun dance lodge (cf. Kroeber 1908:261-268). The central dividing boulder line might represent a portion of an original exterior lodge wall which possibly was partially disturbed when a second large lodge was added during the construction of a ceremonial double tipi lodge (cf. Cooper 1956:Plate 1). While Cooper's illustration shows two lodges pegged to the ground, a different event may have used, or seasonally necessitated, boulders to hold down tent margins. Similar large, ceremonial, double lodges are cited for the Cree (Mandelbaum 1979:211-214), Crow (Denig 1953:61; Lowie 1956:317), Ojibwa (James 1830:188; Howard 1977:135), and Blackfoot who "... used the same (type of) Sun Dance structure as the Crow" (Ewers 1973:59). The central boulder line also might represent a Dakota division of the sexes:

> If a dance were given ... the sexes danced in separate areas, either one on one side and the other on the other, or they formed two distinct lines ... (Hassrick 1964:136).

5.9 Animal Effigy Analogies (Class IIIA).

5.9.1 Turtle Effigies

The Assiniboine's western extension may explain the turtle effigies near Consort in Alberta (Bayrock 1963:3), although these effigies could represent culture borrowing by the Blackfoot. However, as the two western Canadian turtle species, the snapping turtle (Chelydra serpentina) and the painted turtle (Chrysemys picta), occur only in the extreme south of the four western provinces (Behler and King 1979:435, 450), they may have been unknown to northern Blackfoot. The absence of other turtle effigies in southern Alberta, ultimate Blackfoot territory, should add support to the possible occurrence of these figures as representing a different tribe's device.

Turtles were known to be a semi-aquatic food source among the Cheyenne (Grinnell 1962a:307) and Dakota (Hassrick 1964:197). Thus, their depiction on the prairie may have served a double purpose, a direction to water and an indicator of a food commodity. Also the Mandan used turtles in a prominent part of their lore:

> ... some think the turtle effigies were made to win the favor of certain spirits. Others claim they were made to point the weary Indian to good water (Anonymous 1938:19).

An alternative suggestion is that some turtle outlines may indicate a child's birthplace. Many tribes preserved the navel cord in small ornamented pouches:

> Among the Dakota these usually took the forms of turtles and lizards, among the Blackfoot, snakes and horned toads (Wissler 1927:95).

Similar pouches are described for the Arapaho (Hilger 1952:22-23), Cree and Saulteaux (Tarasoff 1980:20), Crow (Lowie 1956:33), and Assiniboine (Mandelbaum 1979:344). If the child born was that of an important leader, the event might have been celebrated by constructing a monument. The "turtles" at 39HU70 and 39HU74, by the length of the tails, might better depict horned toads or reptiles not common to Manitoba, Saskatchewan, or Alberta. This difference is notable in the uniform depiction of the carapace outlines and the leg and tail portrayal of most other turtle outlines (see Table 8 and illustrations).

5.9.2 Badger Effigy

The Minton Turtle Effigy, DhNe-2 (Fig. 73), depiction might better describe a badger outline. The presence of human ribs might denote an individual's burial at a divining (scrying) site where:

> Scrying occurred in the form of peering into badger blood. When a war party had gone out on the trail, they would kill a badger, lay it on its back, slit it from throat to crotch, and leave the blood to gather in a pool around the belly ... If the scryer on peering into the surface of the blood, saw himself headless or scalped, this meant he would get killed. If he saw himself reflected clearly this meant good luck (Cooper 1956:419).

A similar meaning for badger scrying occurred among the Cree (Mandelbaum 1979:176), though the Dakota interpreted scrying as a common practise with a different meaning:

> ... when a man kills a badger, if he turns it on its back, cuts open the chest and carefully removes its insides so that no blood is lost, when the blood thickens, by looking in the hunter can see his image. Should he see himself as he is, he knows he will die young. But if he sees himself as an old man with white hair ... Now he knows he can risk getting many coup and will live long to die with a cane in his hand (Hassrick 1964:192).

The location of numerous small cairns within the outline circumference might better describe Atsina badger scrying (Cooper 1956), as the cairns may be the locations of certain internal viscera. Alternatively, if a Dakota believed he could take many risks and inadvertently was killed during a local event, he might have been interred at his scrying site.

L. Uyttenhager's mention of a "boulder (with) a face and numerous other marks incised in it" (McCorquodale 1961) seems representative of some form of monument marker. The Ojibwa, late residents of this area of Saskatchewan, marked graves with petroglyphs:

> ... a small post with the tribe mark was placed at the head of a grave (Grant 1960:364).

In the absence of trees for a post marker, a large boulder could have served the same purpose. As the boulder had been removed and is not available for present inspection, it is impossible to ascribe definite tribal use-identification to this feature. The feature's outline and specific ears and legs depictions should, however, define it better as a badger than as a turtle.

5.9.3 Salamander Effigy

The salamander outline at DiNs-1 might represent more than an animal's form. The two lateral neck boulder depictions (see Fig. 74) might suggest other possibilities. The adult land phase of a salamander is characterized by its having lost its external gills, whereas an underfunctioning thyroid may result in the individual's failure to develop into a land salamander (Stebbins 1951:46-47). The undeveloped aquatic phase (*Ambystoma tigriuum axolotle*) usually exceeds the growth size of its land counterpart (K. Roney, SMNH biologist, personal communications). The figure might represent the aquatic mudpuppy (*Necturus maculosa*), which also possesses external gills. Both of these amphibians possess gills which define their water habitat:

> Short gills indicate well oxygenated water, whereas long branching gills indicate muddy or poorly oxygenated water (Stebbins 1951:47).

As this boulder monument salamander possesses short boulder lines posterior to the head, it may be a signal for a fresh water supply.

As one alternative, the salamander outline might have served as a monument of a child's birthplace, as was cited for navel cord preservation ornamented pouches among the Blackfoot (Wissler 1927:95), Arapaho (Hilger 1952:22-23), Crow (Lowie 1956:33), and Cree (Mandelbaum 1979:139, Tarasoff 1980:20). A second alternative might suggest the death site of a Cree, Saulteux, or Assiniboine prevaricator as:

> ... no stories founded on fiction were ever told. The Indians, with their intensely superstitious natures, believing that if any "fairy tales" were told during that season (summer) when they were supposed to use all their time to the very best advantage, the narrator would have his or her life destroyed by the lizard which would suck all his blood. The Indians, very naturally, were in terror of this little reptile, which was never actually known to have been the cause of any loss of life among them; but they assert as a reason for this that no Indian ever gave it an opportunity to put to test its evil powers (Paget 1909:100).

As true lizards are absent in Saskatchewan, a salamander may have been depicted to represent a lizard myth.

As a third alternative, this effigy may propose a Plains Indian water monster. Known as Unktehi among the Oglala Sioux and represented in the art of the Sioux, Blackfoot, Arapaho, and Cheyenne, water monsters were believed to occupy certain lakes and rivers where they:

> ... made floods by spewing water from their mouths; they caused alkalai and muddy or bad waters as well as accidents and drownings in lakes and streams. With their tails, they shot people or animals who entered the water causing their victims to cramp and sink below the surface, where the monsters ate them (Ewers 1981:39).

These powerful beings were depicted as horned snakes, serpents with horns and legs, or as a:

> ... very large male creature with horns on its head, teeth as sharp as knives, four legs, and a long, strong tail (James R. Walker in Ewers 1981:39).

Similar beings have been depicted in pictographs along the Churchill River in Saskatchewan (cf. Jones 1981:21, Figures 14 and 15) and on the Molson River in Manitoba (cf. Dewdney 1978:118, site 241). The Saskatchewan pictographs conform to effigy depictions described by Ewers (1981:41), whereas the Manitoba depiction seems to conform to the thunderbird - monster confrontation pose depicted by Dick West (in Ewers 1980:38, Fig. 1,44).

This salamander boulder monument might, then, depict a local source of fresh water, a birthplace, a deathplace, or a warning of the locations of a water monster. With so many possibilities, it is impossible to attempt to suggest any individual cultural significance.

5.9.4 Bison Effigy

The bison effigy at DgNh-3 (Fig. 72) may represent the "muzzineneen" or medicine hunt as practised by Algonkian Indians and mentioned by Tanner in his narrative, where he says:

> ... we were so reduced to hunger that it was thought necessary to have recourse to a medicine hunt ... A drawing, or a little image is made to represent ... the animal on which the power of the medicine is to be tried (James 1830:164).

These images were noted to have been made from materials readily available in a woodland situation:

> ... whether of carved wood ... or sketched on birch bark, or even traced in the sand (James 1830:181).

In the absence of woodland materials, a boulder outline seems a plausible format.

When the figurine was completed:

> ... the part representing the heart is punctured with a sharp instrument, if the design be to cause death (James 1830:164).

This form of sympathetic magic, also known among the Menomini, involved touching the part of the body which was to be affected and then shooting the image with an arrow (Mandelbaum 1979:315).

Local artifact collectors related that they had found a number of broken arrowheads in or near the buffalo effigy. Theoretically, those artifacts might represent those projectile points which directly struck the boulders depicting the heart. A comparative figure (Fig.

82) and narration mentioned by Tanner give the hunter's thoughts and Tanner's interpretation:

> I am such, I am such, my friends, any animal, any animal my friends, I hit him right my friends. (This boast of certain success in hunting, is another method by which he hopes to elevate himself in the estimation of his hearers. Having told them that he has the power to put them all to death, he goes on to speak of his infallible success in hunting, which will always enable him to be a valuable friend to such as are careful to secure his goodwill.) (James 1830:344).

Only one other bison effigy boulder monument was located for the northern Great Plains. This figure, recorded by T. H. Lewis (1890) in Minnesota, has some similarities (Fig. 81) with the Saskatchewan bison effigy. The Minnesota effigy is similarly depicted in sagittal section with its legs oriented toward the southeast but with its head toward the northeast. The legs are shown as two outlines, one for the forelegs, one for the hindlegs. Large boulders were placed at the eye, on the hump, and forward to the hind leg outline. The latter boulder might suggest a bison cow's udder. If it is a cow, it might suggest a spring construction when the cow herds congregated ~~prior to~~ rut (cf. Arthur 1975). However, the effigy may not represent a medicine hunt at all, as a heart-line is not depicted.

5.10 Human Effigy Analogies (Class IIIB)

5.10.1 Wildman Butte Human Effigy

Comparisons of some of the elements noted by Clandening (1928) with ethnological records suggests the probable meaning of the site and possible tribal association. The medicine hunting, previously noted from "Tanner's Narrative," describes an Ojibwa method of obtaining game which possesses all the elements depicted at this site:

> I draw up your heart, that is what I do to you. It is intended

> here to represent a moose at a distance: and the line from his heart to the lodge of the Indian, indicates that he draw it, or by means of the power of his medicine controls the inclination of the animal, and brings him to a situation where he can easily be found (James 1830:372, Fig. 10).

The figure depicted by Tanner (Fig. 82) was to represent a moose. In the absence of a woodland environment an elk figure was incised into the sod (cf. Clandening 1928:260). The elk described by Clandening was no longer evident on Wildman Butte in 1980. The heart stone also was missing; however, a slight ridge erosion leading from the peak down to the stone circle was still evident. The line in Tanner's illustration leads from the animal's heart down to a lodge (cross-section) figure (cf. James 1830:372, Fig. 10). The human outline was depicted in sagittal section by Tanner as compared to a ventral view at DgNc-1; however, the interesting aspect is the illustration of a long knife or spear across the waist of the human figure. The boulder line at DgNc-1 extending from the rear of the boulder figure to in front of the figure might then represent a holstered weapon rather than the speculated:

> ... arrow or spear stuck into the figure's backside and the ... splash zone bathroom humor (Dyck 1981:56,57).

Dyck does, however, acknowledge McCorquodale's 1961 recollection of the possible boulder alterations of this portion of the effigy's anatomy (Dyck 1981:54).

Additionally, the Mandan were noted to depict certain effigies by cutting outlines into the sod in 1823, some of which were visible as late as 1923 (Gilmore 1929:147-151). Theoretically, the outline of an elk cut into the prairie sod may suggest elements of Mandan culture or of an Ojibwa-Mandan culture amalgamation.

A full body depiction with the limbs outlined instead of represented as stick-like appendages is common among the Plains Ojibwa Midewiwin (Dyck 1981:68). The Midewiwin ceremony, also known as the "Grand Medicine Lodge" and involving medicine, magic, and forms of witchcraft, was absent:

> ... among the plains Algonkians (Blackfoot, Arapaho, Cheyenne) (which) would make it appear that the ceremony must have had its rise and spread after these people had become detached from the main stock (Hallowell 1936:34).

Consequently, since the Midewiwin "was confined to ... the central Algonkians ... (and) Siouan tribes (in their) immediate contact" (Hallowell 1936:33), it would seem reasonable that full body depiction could be attributed to the Ojibwa (Dyck 1981:68) or some Dakota tribe.

5.10.2 Kayville Human Effigy

The human effigy at DkNg-2 (Fig. 84) was the only effigy surrounded by a square of boulders. The lack of gender depiction at this site and its similarity to an Ojibwa pictograph (Fig. 84a) may propose a meaning like that which Tanner indicated in a love song:

> 'Were she on a distant island, I can make her crazy to swim over, were she on a distant island.' Here he again boasts of the power of his medicine over the inclinations of females. This song seems to present a fair view of the state of passion of love among the Ojibeways (James 1830:372 [13]).

As this area of Saskatchewan was formerly occupied by Plains Ojibwa (Bungi), it is possible that this figure may represent an individual Ojibwa'[illegible] site of practising his love medicine. On the prairie, devoid of birch bark (the medium employed in Tanner's reference), this similar depiction was outlined with boulders.

5.10.3 Dewdney Avenue Human Effigy

While no specific ethnographic reference was located to support an explanation for the figures at the Dewdney Avenue Human Effigy site

EcNh-1, a custom of disfigurement for infidelity practised by many plains tribes might explain this monument's presence:

> A husband's hostility toward an unfaithful wife was sadistically exhibited by his right to cut off the tip of her nose. Such a disfigurement not only marked his wrath upon her for life and surely reduced her attractiveness to other men, but it made permanently public the male's position of dominance and authority (Hassrick 1964:136).

The preceding Dakota custom also was practised by the Cree (Mandelbaum 1979:295) and by the Blackfoot (Corbett 1934:136). A photograph of a Blackfoot woman punished for an adulterous relationship illustrates the hideous result of the punishment (*cf*. Ewers 1958: plate preceding page 95).

If the child depicted was newborn, the material in the woman's right hand might represent the secundines while the extending boulder line could represent a blood trail. The elevation of the secundines illustrates that the woman may have been unattended during delivery. Usually the midwife wrapped and hung this material in a tree to prevent dogs from consuming it (Mandelbaum 1979:139). Also it was a Cree belief that by protecting this material the child would be "prevented from becoming a thief when it grew up" (Dusenberry 1962:90).

The valley location of this boulder monument is an anomaly. No other boulder effigy observed or located by this research occurs in a valley or on landscape lower than the immediate bordering topography.

One possible explanation may support the infidelity supposition where a "fallen woman" may have been ejected from a campsite (stone circles are evident on top of the valley rim adjacent to this figure). Such an incident may have been commemorated with this boulder monument - which is visible from the top of the hill.

5.10.4 Cabri Lake Human Effigy

The Cabri Lake (EgOk-1) Human Effigy with the hands extended over the head is similar to the Wildman Butte depiction. Tanner explains this arm elevation to signify an Ojibwa "look at me" pictograph depiction (James 1830:341). The very definite sex depiction together with the well-defined heart-line may be compared with Tanner's:

> Look at me well, my friends; examine me, and let us understand that we are all companies (James 1830:341).

Or, as James interprets it to mean:

> The words express the boastful claims of a man, who sets himself up for the best and most skillful in the fraternity (James 1830: 341-342).

Therefore, the depiction of possible stomach anomalies by the distinct location of boulders in the stomach region may have purposely been placed to indicate a specific individual's characteristics.

5.10.5 Human Effigy Discussion

The rectangular human effigy body forms have been identified by others to represent Algonkian depictions (cf. Dewdney 1965, Habgood 1967). The difference is that some Algonkian human effigies have pointed shoulders and a 'V' neck appearance on the upper torso, whereas the Saskatchewan boulder outlines have square shoulders without a 'V' neck.

Clandening's 1863 observation of the Wildman Butte effigy holding a bow and arrow in one hand (1928:260) presents an anomaly among northern Great Plains human boulder effigies. The only comparison located illustrated three west Texas pictographs "showing men with bows (in one hand) and curved clubs (in the other hand)" (Heizer 1942:50).

Only the Cabri Lake and Dewdney Avenue effigies have definite sex depictions. The sex of the Wildman Butte effigy was not discussed by Clandening (1928) and only speculated upon by Dyck (1981), while the sex of the Kayville effigy is suggested only by the possible comparison with an Ojibwa pictograph. Perhaps the best observation is:

> Sometimes we walk a tightrope between scientific anthropology and lewd sexology ... while such sentiments accurately reflect the prejudicial notions of propriety valid in our own culture, they should, nevertheless have no place in the dispassionate examination of the cultural manifestations of other peoples who follow their own rules of etiquette ... (Wellman 1974:2).

5.11 Geometrics Analogies

The geometrics encountered in Saskatchewan and from published accounts are dispersed across the Northern Great Plains. While some concentrations of vision quest geometrics appear to be in southern Montana and in north and eastern Wyoming, their presence elsewhere, both peripherally and across the study area (see Table 11), prohibits any speculation concerning diffusion of ceremony(s). Included in geometrics are a number of monuments described by their possible functions which seem to relate to ethnographic accounts.

5.11.1 Subclass IVA. Vision Quest Site DkOj-2

The information qualifying DkOj-2 as a vision quest site is that such sites:

> are commonly 'U' shaped or oval, at the discretion of the individual or his elder instructor, and may consist of a single rock tier or several tiers up to 3 feet in height (Fredlund 1969:15).

The 'U' shape commonly had an accompanying alignment which reflected some aspect of the experienced vision, but there weren't any definite regulations (Cooper 1956).

Also, DkOj-2 is assumed to represent a vision quest site based on its similarity to a recorded Atsina site reported by Little Man:

> he was lying face down and he heard something, just like something puffing, coming towards him. He said he knew right away what it was because from what he had heard old people say, the bear when it travels puffs a whole lot as if it were out of breath. So he knew it was a bear. He didn't pay any attention. He just lay there and kept praying and praying. The bear went in a circle right around him. Pretty soon the bear came over. Little Man had a little oblong nest outlined with rocks piled up about two or three feet high, and open toward his feet. This is called his 'call-for-power' lodge. After the bear had come around several times it must have sat down because Little Man didn't hear him anymore. He wasn't supposed to look up to see what it was that came to him ... You just have to take whatever it is and just think hard about the power you want.
>
> So when the bear came over he put his paw right on Little Man's head. He went away again and soon after he came back again and put his paw on Little Man's back just at the level where his heart was. The bear went off again and Little Man noticed that he went straight back from his head. The third time when he came back he touched the soles of Little Man's feet. He went off again the same way and not so very long after he came back and this time he sat down towards the opening of the nest about 10 to 12 feet away from it (Cooper 1956:285-286).

The preceding narrative closely describes the DkOj-2 structure. The circle that the bear walked could be the oblong nest ('U') periphery, the three walks away might be represented by the three boulder lines, and the location where the bear sat down could be represented by the dolomite boulder. While DkOj-2 is probably not Little Man's site, there are a sufficient number of similarities to qualify this as a vision quest site. The isolated and exposed location was suitable for a "denial until a vision was received" (Wildschut 1960:7). Often the denial was accompanied by the "sacrifice of strips of flesh or the dismembering of a finger joint" (Cooper 1956:285,290). This self-torture was sought:

> ... on continually recurring occasions - for mournings, for warpaths, for revenge, for curing disease, or in consequence for vowing during disease, for a name for a child, for a design for entrance into a society; and on all these occasions the seeker ordinarily receives his power or commands directly without specifically acquiring a guardian spirit (Benedict 1923:29).

DkOj-2 might be attributed to the Atsina because of the close construction resemblances. Cree, Saulteaux, and Sarcee vision quests, restricted to boys who had not indulged in sexual relations, usually occurred on an elevated wooden platform, in a bear's den, or on a raft anchored off-shore (Mandelbaum 1979:159-160). Blackfoot quest lodges were more commonly constructed from brush (Corbett 1934:24), while the Crow built a boulder platform upon which to recline (Wildschut 1975:7).

The fire-cracked rock located near this vision quest monument possibly indicates that the visionary may have undergone a sweat lodge ceremony to cleanse his body. Sweat lodge structures were constructed from willow shafts stuck in the ground in a small circle, the upright tops tied across the circle to make a conical hut which was covered with robes or brush to constrict the steam. Rocks were heated outside the lodge and passed in by helpers (cf. Hilger 1952:129). Water was trickled over the rocks to produce steam (Lowie 1976c:429).

> The Blackfoot and Cheyenne restrict the use of a sweat lodge for ceremonial purposes (although) the Crow and Flathead tribes use the sweat lodge for pleasure as well as for personal hygiene (while) to the Cree, the sweat lodge is a vital element of their lives not restricted to ceremony or mere pleasure (Dusenberry 1962:120).

Nineteen other visionary sites with 34 'U' shaped nests or ovals have been identified on the Northern Great Plains. Specifically there are 15 sites with 29 features in Montana, three sites with four features in North Dakota, and a single feature site in South Dakota (see Map 6 and Table 11).

5.11.2 Subclass IVB. War Lodge Structure DgNf-5

This feature was defined as a war lodge after the description and illustration of a Blackfoot structure (cf Ewers 1944: plate page 184, 185). The structures were made primarily of logs overlain with brush.

TABLE 11

NORTHERN GREAT PLAINS AND NEIGHBOURING BOULDER GEOMETRICS

Site Designation	Geometric Type	Political Area	Reference	Text Figure
DgPn-28	G	Alberta	Carpenter 1975:38	101
DkOj-2	V.Q.	Saskatchewan	This research	100
DgNf-5	W.L.	Saskatchewan	SMNH	102
DkOe-2	G	Saskatchewan	Watson 1975:20	103
EaKu-7	G	Manitoba	Buchner 1976b:33	104
EaKu-8	G	Manitoba	Buchner 1976b:31	105
EaKu-9	G	Manitoba	Buchner 1976b:34	106
EbKu-9	G	Manitoba	Buchner & Callaghan 1980:98	107
EaKv-14(#2)	G	Manitoba	Buchner 1976a:16	108
EaKv-14(#3)	G	Manitoba	Buchner 1976a:17	109
EaKv-le(#6)	G (?)	Manitoba	Buchner 1976a:20	110
EaKv-21	G	Manitoba	Buchner 1976b:35	111
EgKx-8	G	Manitoba	Carmichael 1979:97	N

Site Designation	Geometric Type	Political Area	Reference	Text Figure
EgKx-15	G	Manitoba	Carmichael 1979:8	112
EgKx-23	G	Manitoba	Carmichael 1979:98	N
CbGu-1	G	Ontario	Tyyska & Burns 1973:17-23	113
CbGu-2	G	Ontario	Tyyska & Burns 1973:23-27	114
CcGa-1	G	Ontario	Tyyska & Burns 1973:27	115
24CB410	V.Q.	Montana	Conner 1982:90 (Fig.2)	N
fasting bed	V.Q.	Montana	Conner 1982:92 (Fig.3)	N
24CB654	V.Q.	Montana	Conner 1982:94 (Fig.4)	N
fasting place	V.Q.	Montana	Conner 1982:97 (Fig.7)	N
24BH417	V.Q.	Montana	Conner 1982:102,103 (Fig. 9,10)	N
24BH665	V.Q.	Montana	Conner 1982:105 (Fig. 12)	N
24BH665IV	V.Q.	Montana	Conner 1982:106	N
24CB420	V.Q.	Montana	Conner 1982:111 (Fig. 16)	N
24PA551	V.Q.	Montana	Conner 1982:114 (Fig. 17)	N
24CB411	2-V.Q.	Montana	Conner 1982:87	N
24CB419	4-V.Q.	Montana	Conner 1982:91	N
24PH70	G	Montana	Davis 1975:32	116

Site Designation	Geometric Type	Political Area	Reference	Text Figure
24HL28	3-V.Q.	Montana	Keyser 1979:21	N
24CB750	3-V.Q.	Montana	Loendorf 1969:49	N
Pryor Mountains	5-V.Q.	Montana	Wedel 1961:266	N
Glacier Park	3-V.Q.	Montana	Kehoe 1958:431-432	N
48FR302	G	Wyoming	Rea 1966:15-21	117
Custer County	G	South Dakota	Over 1941:47	118
Custer County	G	South Dakota	Over 1941:48	119
Custer County	G	South Dakota	Over 1941:49	120
39CU46	G	South Dakota	U.S.D.(*) 1981	N
39FA150	G	South Dakota	U.S.D.(*) 1981	N
39FA168	G	South Dakota	U.S.D.(*) 1981	N
39FA186	G	South Dakota	U.S.D.(*) 1981	N
39FA341	G	South Dakota	U.S.D.(*) 1981	N
39FA369	G	South Dakota	U.S.D.(*) 1981	N
39FA383	G	South Dakota	U.S.D.(*) 1981	N
39HU227	G	South Dakota	U.S.D.(*) 1981	N
39HU352	G	South Dakota	U.S.D.(*) 1981	N

Site Designation	Geometric Type	Political Area	Reference	Text Figure
39HU353	G	South Dakota	U.S.D.(*) 1981	N
39JE4	G	South Dakota	U.S.D.(*) 1981	N
39JE6	G	South Dakota	U.S.D.(*) 1981	N
39SL85	G	South Dakota	U.S.D.(*) 1981	N
39SL92	G	South Dakota	U.S.D.(*) 1981	N
39SL136	G	South Dakota	U.S.D.(*) 1981	N
39SL143	G	South Dakota	U.S.D.(*) 1981	N
39SL146	G	South Dakota	U.S.D.(*) 1981	N
39SL147	G	South Dakota	U.S.D.(*) 1981	N
39SL149	G	South Dakota	U.S.D.(*) 1981	N
39SL158	G	South Dakota	U.S.D.(*) 1981	N
39SL162	G	South Dakota	U.S.D.(*) 1981	N
39SL163	G	South Dakota	U.S.D.(*) 1981	N
39SL168	G	South Dakota	U.S.D.(*) 1981	N
39SL175	G	South Dakota	U.S.D.(*) 1981	N
39SL177	G	South Dakota	U.S.D.(*) 1981	N
39SL179	G	South Dakota	U.S.D.(*) 1981	N

Site Designation	Geometric Type	Political Area	Reference	Text Figure
39SL186	G	South Dakota	U.S.D.(*) 1981	N
39SL213	G	South Dakota	U.S.D.(*) 1981	N
39SL229	G	South Dakota	U.S.D.(*) 1981	N
39SL230	G	South Dakota	U.S.D.(*) 1981	N
39SL232	G	South Dakota	U.S.D.(*) 1981	N
	V.Q.	South Dakota	Howard 1972:300	N
32MN40	V.Q.	North Dakota	Fox 1980:88	N
32MN41	V.Q.	North Dakota	Fox 1980:88	N

Legend: G - geometric
V.Q. - visionary site
W.L. - war lodge
(?) - disturbed
(*) - computer printout, no illustrations available
N - no illustration available

The base of the logs was supported by a breast work of logs or stones (*cf*. Ewers 1968:126). The resultant boulder outline should confirm the location of a boulder-supported war lodge.

The assumed war lodge, represented by the feature at DgNf-5 (Fig. 102), is the only one located, to date, in Saskatchewan. Though the interpretation is highly conjectural, it might have been constructed by the Piegan, as they often erected a war lodge when within striking distance of an enemy camp (*cf*. Schultz 1980). The location of this lodge among eight habitation circles may suggest that the raiders intended that their opponents discover the structure. In this way the raiders could have intimidated their foes through a realization that the raiders were so certain of success that they camped on their foe's doorstep; alternatively, some tribes believed that such enclosures were possessed by malevolent enemy powers (Schultz 1980:326). War lodges were not destroyed after use, as they were sometimes repaired by whatever war party that came upon a structure during a raid (*cf*. Malouf 1963:4).

The majority of known war lodges are attributed to the Blackfoot, and are recorded in Montana and Wyoming (*cf*. Christensen 1963; Ewers 1944; Kidwell 1969; Schultz 1978, 1980).

> It seems that pits and lodges were commonly used in the western half of Montana while war lodges, but not pits, characterized the native uses in the eastern half of the state (Malouf 1963:10).

DgNf-5 is located about one kilometer north of the Canadian-American border above the eastern area of Montana, qualifying Malouf's observations.

These structures also were constructed in softwood forest environments, as noted by Yellowstone Kelly beyond the territory occupied by the Hidatsa (west?):

> They built the huts teepee fashion on poles and covered them with a thick coat of cedar and pine boughs, and they were very comfortable as long as they were fresh and green (Quaife 1926:85).

The location of at least one site in Saskatchewan may not be peculiar, as the Blackfoot were reputed to have occupied this area until they were forced out by the Cree and Assiniboines. The location of this site might, then, suggest an excursion by Blackfoot into enemy territory after the time of their displacement.

5.11.3 Subclass IVC. Quarry Site DkOe-2

The possible quarry site at DkOe-2 also does not have a comparable outline on the Great Plains. Since it was first published (cf. Watson 1975:20), various reviewers have speculated that the outline possibly represents a bird, a locomotive, or a dog (cf. Fig. 103). As the outline is not comparable, its construction of only iron-stained quartzite cobbles may have been to alert adept observers to a workable lithic material. None of the boulders in the 45 habitation circles were of this rock type. The floodplain and creek banks to the west of the site revealed some quartzite boulders; however, the upper beach ridge on which the monument was located possessed numerous iron-stained quartzite cobbles. The majority of the lithic tools located within the two excavations were constructed from iron-stained quartzite cobbles.

A similar patterned site was located south of DgNf-5 in Montana (cf. Davis 1975:30). It is not known whether the sites are related, as Davis did not mention a common rock type used for the construction; however, the similarity in monument depiction (cf. Figs. 102 and 116) may suggest some relationship.

As a test to the validity of this figure representing an indication of a workable lithic material, two other known Saskatchewan quarry sites and their environs were surveyed. While neither site revealed any possible boulder configurations within a two kilometre radius, the concentrations of spalled lithic materials (a fused shale and a crypto-crystalline quartzite) were in sufficient surface quantities, so that a boulder monument may not have been required to locate either quarry site.

5.11.4 Other Examined Geometric Sites

The Thunderbird nests listed by Carmichael (1979) may serve as visionary nests in Manitoba (Fig. 112); however, in this research they are listed as defense shelters, based on descriptions noted by J. J. Bigsby in Lake and Cook counties of Minnesota during his survey on the British boundary in 1823:

> ... a hollow pile of stone at the lower end of one of the rapids between Bois Blanc lake and lake Croche, where the Chippewa or Wood Indians in former days used to watch for their invaders, the Sioux of the plains, a race of horsemen and warriors. He also says that until lately the arrows of the Sioux, shot during a conflict on lake Croche, might be seen sticking in the clefts of the rocks there. In lake Lacroix, a few miles from the Pewabic (or Bottle) portage on an island near the south main, are the remains of a round tower, or defensive building of some sort, 27 feet in diameter. It was erected by the Indians and commands a wide view of expanse and woody isles (in Winchell 1911:379).

The recovery of "arrows" may suggest an offensive action; however, other tools might suggest an assemblage necessary to maintain a person during an extensive sentinel. The physical discomfort experienced by Carmichael while testing the "Thunderbird's Nest" (1979:102) may have been partially due to boulder settling and frost upheaval rearrangements of the structure in the years since it was constructed. The hordes of mosquitoes which afflicted him (Carmichael 1979:102) in conjunction with the presence of ceramics at EgKx-15 (Carmichael 1979:38) might suggest that containers were used for the transportation of:

> ... the oil (of which it [the bear] yields several gallons) is useful to anoint their hair and to rub on their bodies, in order to defend them from musketoes ... it is an excellent substitute for butter and makes even the poorest meat palatable (Grant 1960:344).

Visionary sites were located in isolated or dangerous situations (Benedict 1923:1; Schultz 1980:144-154) away from campsites. Additionally, persons seeking visions usually fasted (Conner 1982:85), thereby not requiring containers for foodstuffs. The proximity of EgKx-15 with a campsite should rule out its use as a visionary site. Thus EgKx-15 and the three similar constructions at Wanipigow Lake (Carmichael 1979:97-98) may have been built for uses other than as visionary sites. Three of the Manitoba sites discussed ~~are within~~ the immediate vicinity of water, and all four have a commanding view of the immediate waterways (cf. Carmichael 1979:107-121); therefore, their use as defense/lookout shelters may be a more persuasive analysis. Similar shelters were noted in Montana as defense-observation lookouts (cf. Schultz 1980:213,326; Lamb 1970:109).

Nineteen other geometrics are listed in Table 11 and illustrated in the List of Figures (Figs. 104 to 119). An additional 31 boulder mosaics (geometrics) were listed by the University of South Dakota (Table 11); however, as they were not illustrated they have been referenced on Map 6 showing only their general locations. While the three Ontario geometrics (Figs. 113, 114, 115) are not located on or near the immediate Great Plains environs, they are included to illustrate the differences between Plains and Woodland boulder monuments.

5.12 Associations of Specific Tribes with Specific Monument Types

This chapter began with examinations of the possible dating of boulder monument construction, together with the possible access routes and associated cultural sources which may have produced the impetus for boulder monument origins on the Northwestern Great Plains. In this regard it is noteworthy that while the Hopewell people had trade networks that spanned the Great Plains, their effigies were constructed of different materials, were larger than most plains configurations, and were mainly fashioned for burial functions. At the same time, if the Middle Missouri Cultures, which may have originated from the Middle Mississippian tradition (Willey 1966:320), were the responsibile agency, boulder monuments should have been encountered throughout the entire expanse of their Missouri River occupations.

To find more plausible sources we must look elsewhere. Thus, it is noteworthy that the major occurrences of boulder monuments appear to be along major and minor rivers. This distribtuion possibly suggests that river valleys were some of the exploitation areas during the term of recording some ceremonial event with a boulder monument.

Examinations of medicine wheels and ceremonial circles illustrate an abundance in distirbution toward the western side of the Canadian plains. The increase was theorized on the basis of recorded constructions of both of these monument types at central and western locations. As the Blackfoot are the only tribe recorded to continue medicine wheel constructions into the twentieth century, it is tempting to credit them with the origin of these features. While other tribes have used medicine wheels for vision quests and other uses (cf. Wilson 1981:337-358), in all instances their uses pertain to employing existing features rather than their construction.

Ceremonial circles were subdivided into four varieties. While Matoki Lodges seem to pertain to Blackfoot women, the other ceremonial circles possibly represent universal northern plains traditions because of the variety of tribes that use them and the variety of functions which they may represent.

The two human effigy concentration areas seem to suggest the possible inauguration of a tradition at two separate centres. The two centers are speculated to represent the division of the Middle Dakota into the Assiniboine and the Yankton proper during their western migrations. Winter counts, as studied by Howard (1976) for the Yankton-Yanktonai, indicate that these types of history records began at least as early as A.D. 1682 (1976:20). Through his discussions of these early histories he states that the Dakota originally employed the use of pictographs to represent "the most important or unusual event of the past twelve months" (Howard 1976:1-2). It is possible that boulder monuments are the pictographic location of the noteworthy event outlined on the ground surface using boulders as a permanent marking device.

The geometric boulder monument types cannot be assigned completely to any specific tribal entity, either by type or variety. While the vision quest site at DkOj-2 seems to mirror an Atsina recorded event, the possibility that this was Little Bear's vision quest nest is too remote to be considered. Since these structures occur in areas frequented by many proto-historic tribes, they may have been built by any number of different tribes. The same idiom holds true for the suspected war lodge remnant and proposed quarry indicator. The major difficulty with each of these sites was in attempting to establish an ethnographic relationship to individual type sites. Without the advantage of numerous sites within each subclass to illustrate variation, these classifications are extremely tenuous. However, each subclass received equal analysis attempts as all other boulder monuments, to illustrate the possibilities of analysis that are available in the ethnographic records.

The geometric sites were subdivided into three subclasses. The single vision quest site was seen to resemble closely a recorded Atsina site by the structure design described in the ethnographic account. The war lodge structure possibly attributed to the Piegan was located in an area frequented by these people when waging war. The uniqueness of the assumed quarry site prohibits any possible tribal association. By its location in southwestern Saskatchewan it could have been constructed by Blackfoot, Assiniboine, Atsina, or by people predating the protohistoric period.

The inclusion of the Manitoba Thunderbird nests was to illustrate that a definition other than a vision quest assessment was possible. As for tribal association, one can only assume that they were constructed by Archaic peoples (Carmichael 1979:85) who were commonly harrassed by others.

5.13 Speculated Boulder Monument Classes by Subclass Analogies

All of the assumed categories have been described with reference to a variety of ethnographic accounts which seem to be synonymous with these features. For each category, the assumed varieties suggest:

Medicine Wheels Class I

Subclass IA: Large Central Cairn - a burial biographical memorial

- Subclass IB: Large Central Cairn Encompassed - a divination monument
- Subclass IC: Small/No Central Cairn - surrogate burial memorial
- Subclass ID: Encompassed Feature - fertility monument

Ceremonial Circles Class II

- Subclass IIA: Circle with definite marked entrance path - Matoki Lodge
- Subclass IIB; Large Circle, Enclosed Boulder(s) - communal assemblage
- Subclass IIC: Enclosed Cairns - landmark/grave site
- Subclass IID: Enclosed Boulder Line - ceremonial dance lodge

Effigy Figures Class III

- Subclass IIIA Animal Outlines
  - Turtle Outline - water source/birthplace
  - Badger Effigy - scrying site/burial
  - Salamander Effigy - fresh water marker/burial/birthplace
  - Bison Effigy - medicine hunt
- Subclass IIIB Human Effigies
  - Male Effigies - male domination/personal environmental control
  - Female Effigies - male subjugation/punishment of females

Geometrics Class IV

- Subclass IVA Vision Quest - personal tribulation
- Subclass IVB Warlodge - stealth encampment

Subclass IVC Quarry - subtle site indicator

Subclass IVD Other Geometrics - defense shelter/sentinel post

- undefined man-made configuration

CHAPTER VI

CONCLUSIONS

6.1 Summary

Data available to 1983 indicated the presence of a minimum of 33 boulder monuments across the southern third of Saskatchewan. Previous investigations of these features, both in Saskatchewan and elsewhere on the Northwestern Great Plains, had created confusion in boulder site classifications. All available diagrammed boulder monument forms were compared with those in Saskatchewan toward establishing a new classification scheme. The achievements or failures of this research can be adjudicated best through an examination of the research propositions.

6.2 Consideration of the Initial Propositions

A review of ethnohistoric accounts provided an examination of resident tribes and their kindred who may have occupied the Saskatchewan plains or entered onto the Northern Great Plains since the twelfth century. Historical explorers' documents recorded early migrations and tribal explorations onto the plains from surrounding environments; however, they presented only sporadic mention of boulder monuments.

This examination of boulder monuments, and the variety of cultures associated with the Northwestern Great Plains, identified four tribes (Blackfoot, Ojibwa, Cree, Dakota) that can be linked directly to some of these features. Other tribes (Mandan, Crow, Sarsi, Assiniboine, Atsina, etc.) may be linked to boulder monuments through their associations with the above tribes, characteristics of some of their cultural activities (as speculative comparisons), or by motif designs peculiar to their specific cultures. The possible Ojibwa-Mandan components at the

Wildman Butte Human Effigy (DgNc-1) and the possible Ojibwa-Dakota components at the Minton Turtle Effigy (DhNe-2) seem to reflect some aspects of seperate cultures amalgamating at isolated sites. As such these components may reflect an economic transfer of ceremony or a cultural exchange of ideology. The concentration of medicine wheels and ceremonial circles in Saskatchewan and Alberta seems to support a Blackfoot or Algonkian origin; however, the more southerly and easterly concentrations of animal and human effigies seem analogous with Ojibwa or Dakota origins. If some of the speculations are correct, particularly those directly analogous to the customs of specific tribes, then there is a definite acceptance of the proposition that boulder monuments do reflect a variety of cultural traditions.

Another proposition involves the spatial locations of boulder monuments and their specific landscape elevations as purposeful indicators of perception, achievement, or group occupation memorials. Ceremonial circles, animal effigies, geometrics, and most human effigies and medicine wheels occur on local secondary heights of land. In Saskatchewan the exceptions are the Moose Mountain Medicine Wheel (DkMq-2) on a local height of land, and the Dewdney Avenue Human Effigy (EcNh-1) and Dick Giles Circle (DgNg-2) in valley complexes. Individually, however, most boulder monument classes have been shown to exhibit certain site peculiarities which could have represented distinct signalling mechanisms to the constructor's tribesmen or allies. The possibility of using animal effigies to illustrate environmental attributes, the use of some medicine wheels to define specific campsite identifications, the possible quarry alignment, and the symbolism of the human female effigies' associations with campsites, suggests that a trained observer could ascertain territorial ownership and local resource amenities. The prospect of the badger effigy symbolism could have served as a campsite identification pertaining to a specific isolated event. A single component of the two human male effigy sites seems evident in the presence of a single stone circle at each of those two sites. The arms-raised symbolism representing a "Here-I-Am" boasting aspect is evident, as a standing person would raise (and possibly wave) their arms above head level to attract others' attentions. Similarly, the isolation of the vision quest site, completely removed from any stone circles, denotes an individual achievement. The associated fire-cracked rock may suggest the presence of an assistant; however, the absence of stone circles supports the near-complete seclusion of the petitioner.

Other problems remain unsubstantiated. Some sites possess numerous stone circles and the presence of cairns within the boulder monument, or have the boulder monument transecting or encompassing stone circles (see Figures 7,8,10-15,17,27,38,40,53,72,87,89,90,109,117). The prospect of stone circles directly associated with the boulder monument should place these entities within the same time component. The increased numbers of stone circles at some monument sites seems suggestive of multiple usage of a favorite campsite. The association of certain cairns at some sites presents an enigma which could not be positively identified through analogy with any of the ethnographic or historic references. One possible explanation is that the boulders within some monuments may have been used to support perishable items (brush with feathers, hair, hide, cloth, etc.) to demark the site on a featureless prairie (as has been hypothesized for the use of the deadmen or cairns in the funnel wings of bison drive sites). When the perishable items fell into disrepair, it is possible that some form of site avoidance (as was mentioned for sundance lodges) may have necessitated marking the site with a peripheral cairn(s) using other perishable items. Ultimate abandonment of the site area would leave only the monument and cairns as visible markers. Where stone circles lie between, or are transected by, medicine wheel spokes, contemporaneity of occurrence possibly may be implied. As has been mentioned, all boulders available were usually used to construct the central feature. Therefore, the presence of stone circles may imply concurrent or a later occupation, as the presence of boulders should have been both impractical and uncomfortable on a lodge's living floor.

A third proposition pertains to the need for an encompassing and universal classification system for Great Plains boulder monuments. By grouping boulder monuments into four broad classes it was possible to recognize variation within each class. The subsequent subclasses were devised on the basis of outline form. In some instances there was only a single monument in the subclass; therefore, greater variety was generated in the subclass by including boulder monuments from outside Saskatchewan. When the subclasses were established, both illustrative and narrative analogies, which best described the speculative functions for the subclass forms, were gleaned from ethnographic, historic, and current accounts. Granted, some of the comparisons are based on tenuous evidence or on a limited variety and sample size; however, it was assumed that each subclass could be compared to some descriptions beyond the previous all-encompassing "medicine wheel" or "effigy" classifications. This comparative analogy exercise was extended beyond the classes and subclasses located in Saskatchewan to attempt to define those monuments better. This selection of comparative analogies does not mean that these comparisons are the only ones available or that they are absolutely correct analogies. Rather, this thesis has been an exercise to examine the possibilities that exist.

Finally, this study was concerned with the proposition that these sites could be dated using lichenometry procedures. Rather than spend extensive time excavating each site for datable carbon samples or possible diagnostic (relative dating) artifacts, lichenometry was attempted as a dating tool. It now appears that there are too many biological and human-induced variables to permit the present successful application of lichenometric dating of boulder monuments on the Saskatchewan Plains. Possibly the technique requires some refinements in lichen fire ecology and in the area of defining thalli establishment and succession rates. The growth rates can be established after identified thalli have been measured over longer periods of time. This examination time also will permit investigations into other radiate lichen species, with possible fewer biological limitations.

The eight proto-historic dates achieved by artifact associations for older boulder monuments (see Table 10), seem to substantiate the recent dates achieved by lichenometry analysis. Consequently, the close grouping of lichenometry dates may mirror reality with respect to the final use of some sites. However, the questionable confidence levels for the lichenometry calculated dates, and the recognized lack of control for the environment comparisons, yield a dating method which is too problematic to be considered precise. While of problematic use for precision dating, lichenometry as a relative dating tool may be of some benefit toward defining different boulder components on a site. The radiate lichens on a site should grow at a constant rate on all boulders. All establishment and succession rates, which are dependant on immediate environmental conditions, should be constant at most boulder monument sites. Therefore, it should be possible to identify early from more recent boulder structures on the basis of thallus sizes on the different boulder structures.

While the designed application failed, the study was included in this thesis as a stepping stone for future archaeologically-related lichenometric research. This point of view justifies the old proverb that recorded negative information is as valid as positive information because it provides an aid toward directing future endeavours.

6.3 Discussion and Conclusions

The major problem in relating ethnographic analogies to boulder monument sites remains the inability to assign definite dates to these features. Only one boulder monument's construction date is precisely known (cf. Watetch 1959). The construction date of 1940 A.D. for Steel's Medicine Wheel (Dempsey 1956) and a possible 1884 A.D. date for the Many Spotted Horses Medicine Wheel (Archaeological Survey of Alberta, field notation) are assumptions rather than dated events. The two radiocarbon dates available for other medicine wheels date buried horizons, whereas the features which define the site's classifications are surface and semi-surface configurations. Better analogies and site classifications may be possible when many more subclasses within each of the monument classes have been excavated and dated with contemporaneous associated materials.

The major classification analysis possibly was the redefinition of medicine wheels and ceremonial circle classes. My opinion is that the parameters defining medicine wheels permits further and better analysis of some structures now listed as ceremonial circles. Specifically, this approach permitted the designation of the assumed Matoki Lodge remnants as configurations denoting separate ceremonial celebrations, rather than following the previously assumed medicine wheel function. This ability to ascribe specific ethnographic analogies to the four medicine wheel subclasses, and to the subclasses for each of the other classes, should propose the possibility that sufficient information is available to qualify some analysis beyond pure speculation.

Regarding the underlying question: "Who constructed or originated the boulder monument tradition on the Great Plains?", I believe that some of these features are an Algonkian invention, while others are of Dakota origin. More specifically, the Blackfoot probably constructed the earliest medicine wheel and ceremonial circles prototypes, whose forms were borrowed by Blackfoot-associated Algonkians; and the outlines possibly were redefined or realigned to fit the others' contemporary mythologies.

The more southerly occurrence of human and animal effigies in Saskatchewan, coupled with the southern Manitoba, Minnesota, and North Dakota effigies, seems to indicate a southeastern to northwestern progression - when compared with ethno-historic tribal movements. The location of a turtle effigy in central Alberta, where turtles do not exist in the natural environment, should aid toward the northwestern progression analysis. As the primary tribe which expanded in that direction was the Assiniboine, a probable Dakota origin is the most plausible analysis. Additionally, the cut-sod outline which accompanied the Wildman Butte Human Effigy in 1867 is similar in nature to a Mandan expression of noteworthy events. A possible Algonkian (Ojibwa) - Dakota (Mandan) amalgamation of cultural traditions may have been reflected at the site.

As the majority of human effigies occur on territories well within recorded Assiniboine exploited districts, they might be inferred as Dakota in origin with the possibility of tradition borrowing or exchange by Algonkian tribes. While it may be possible to assume that the medicine wheels encountered in Saskatchewan and Alberta are probably of Blackfoot origin, it would be incorrect to state the same supposition for all Northern Great Plains medicine wheel sites. The twentieth century continuation of medicine wheel construction (Dempsey 1956) must represent a Blackfoot cultural awareness of an old tradition. Additionally, the near universality of the ceremonial uses for features like the warlodge and vision quest sites together with the fluctuating tribal territories suggests that many tribes may have been responsible for these sites.

If only the need for a comprehensive classification scheme is accepted, then this research will have achieved a major goal. Whether the model presented is accepted or replaced with a different format is irrelevant - a foundation for boulder monument classifications will have been established.

FIGURES

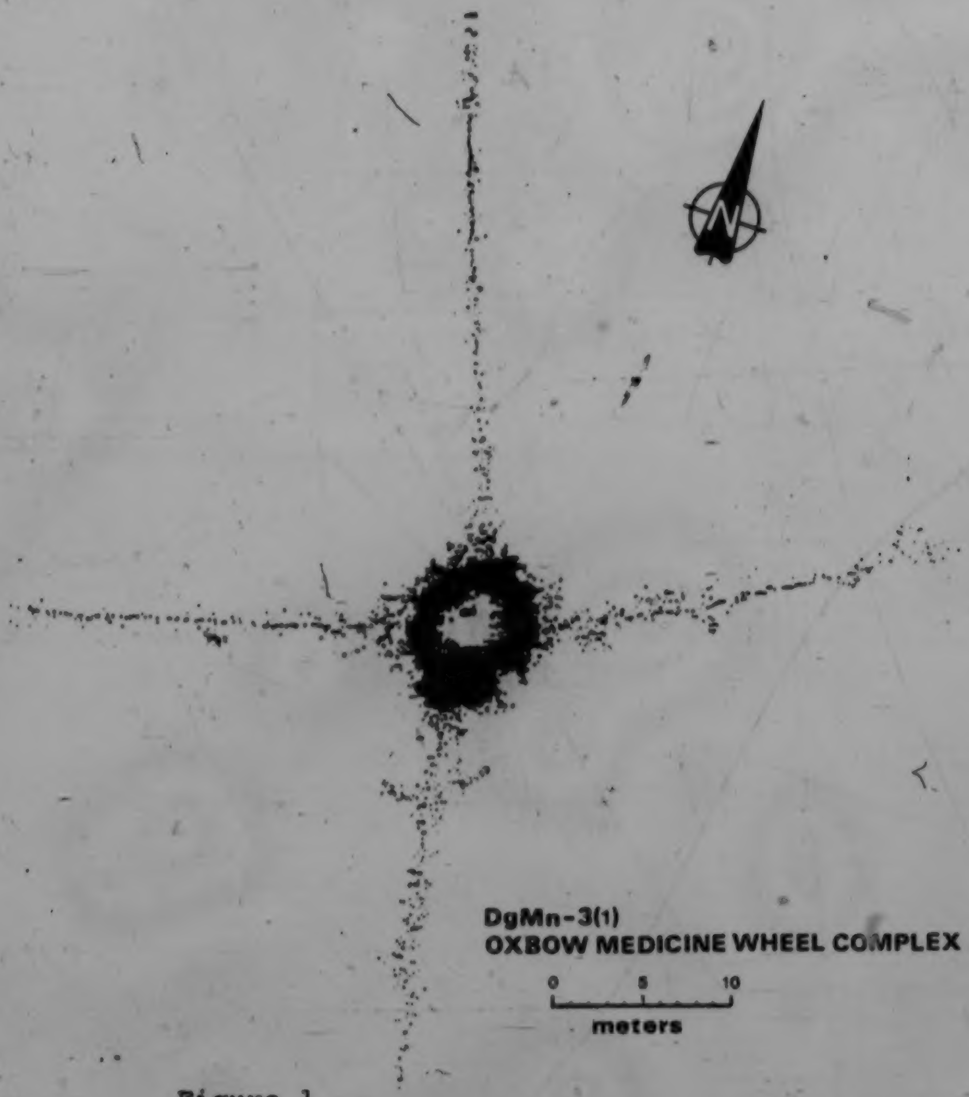

N
DgMn-3(1)
OXBOW MEDICINE WHEEL COMPLEX
0
5
10
meters

Figure 1

(SMNH)

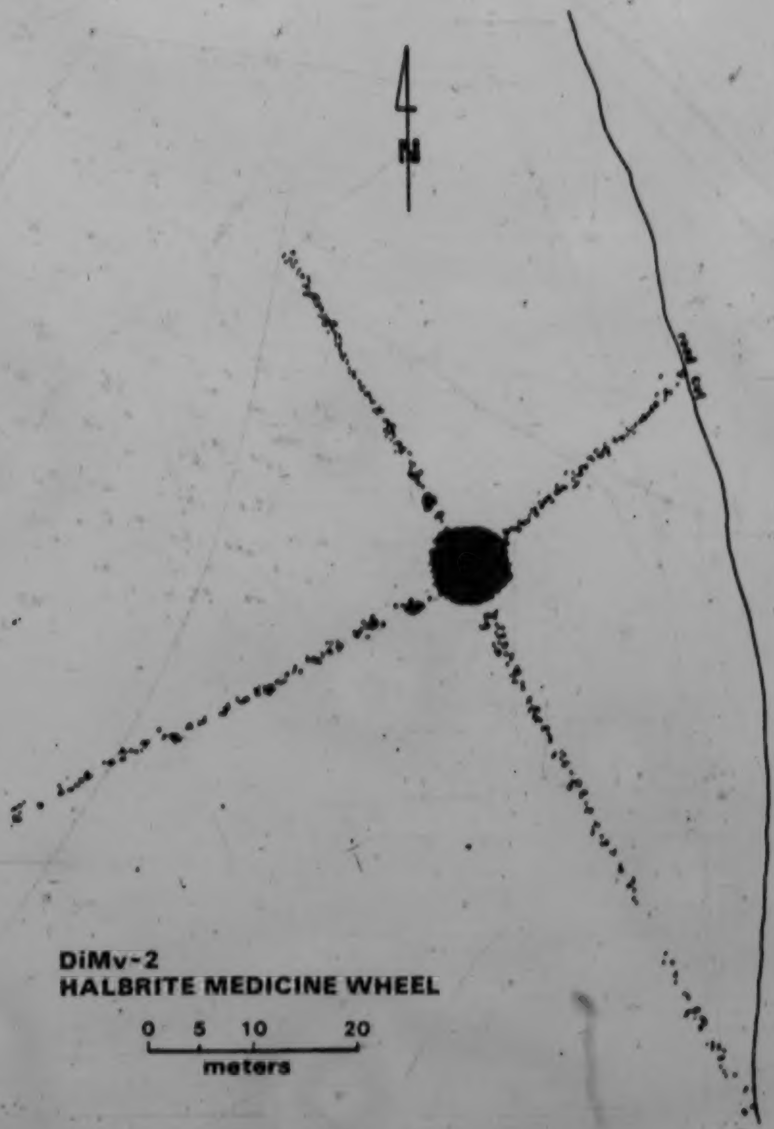

N
DiMv-2
HALBRITE MEDICINE WHEEL
0
5
10
20
meters

Figure 2
(SMNH)

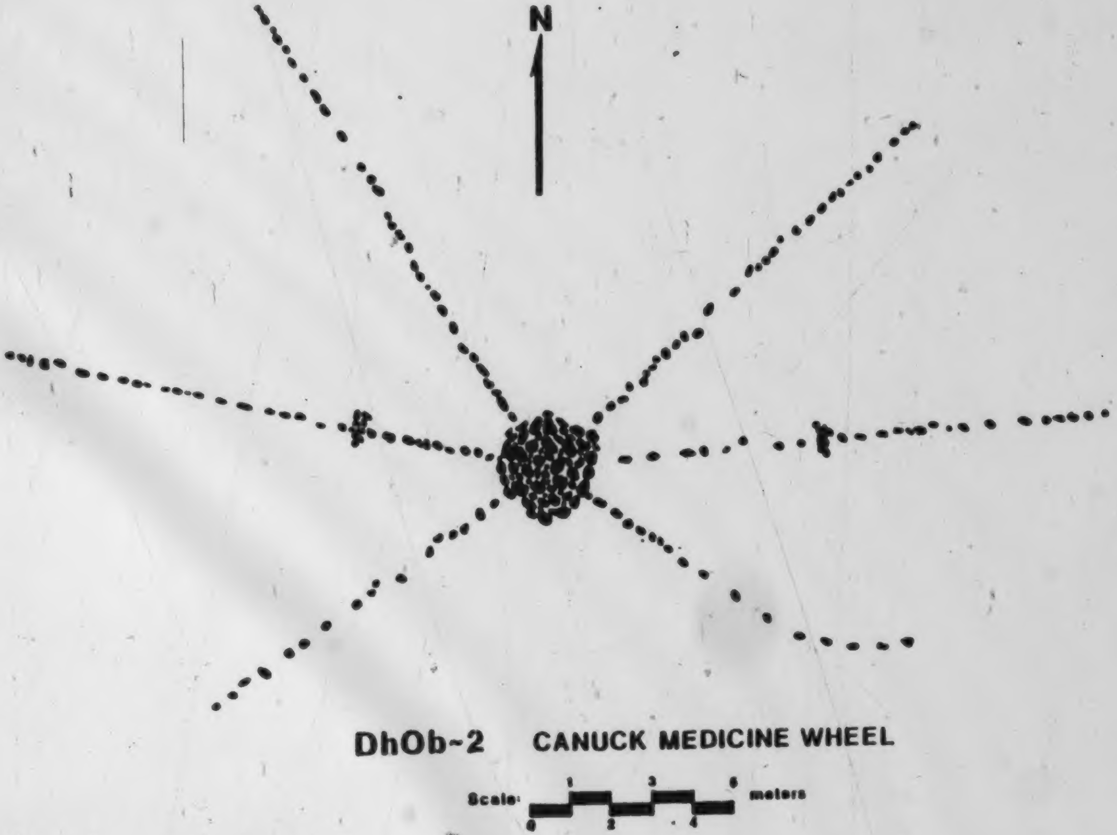

N
DhOb-2 CANUCK MEDICINE WHEEL
Scale: 0 1 2 3 4 5 meters

Figure 3
(SMNH)

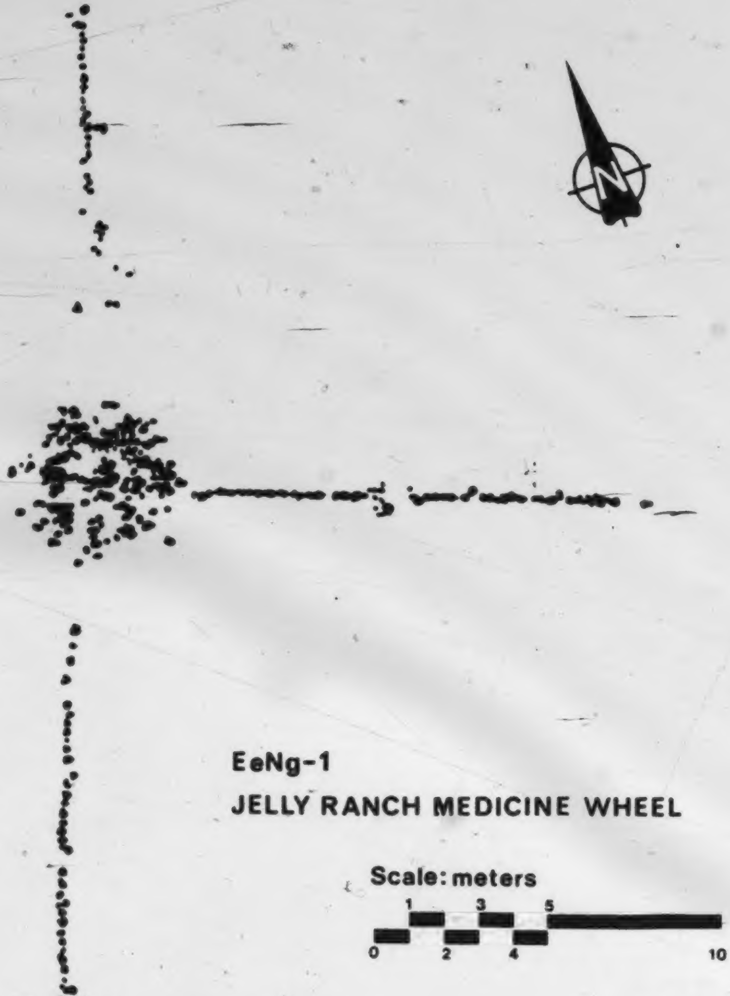

N
EeNg-1
JELLY RANCH MEDICINE WHEEL
Scale: meters
0
1
2
3
4
5
10

Figure 4
(SMNH)

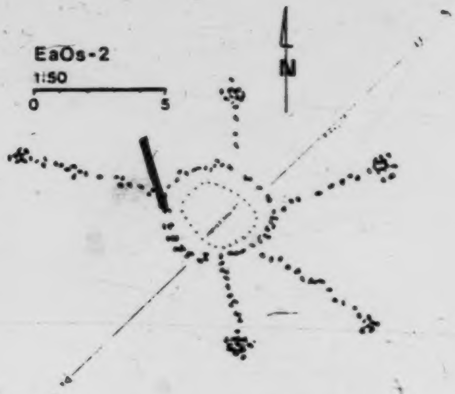

EaOs-2
1:50
0
5
N

Figure 5
Suffield Medicine Wheel (ASA)

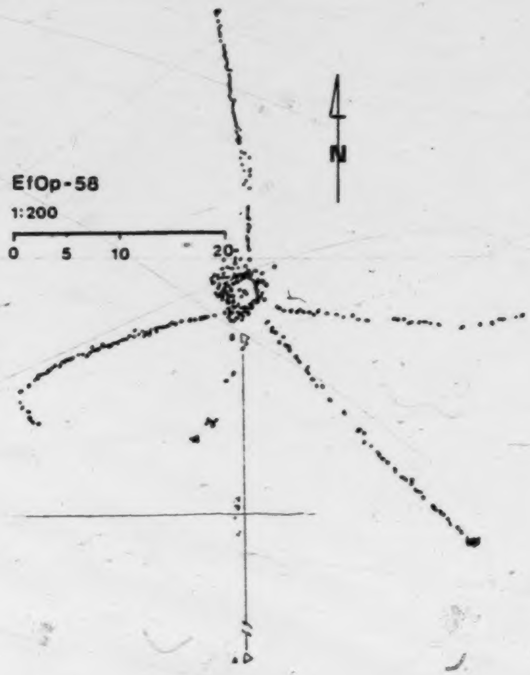

EfOp-58
1:200
0
5
10
20
N

Figure 6
Rinker Medicine Wheel (ASA)

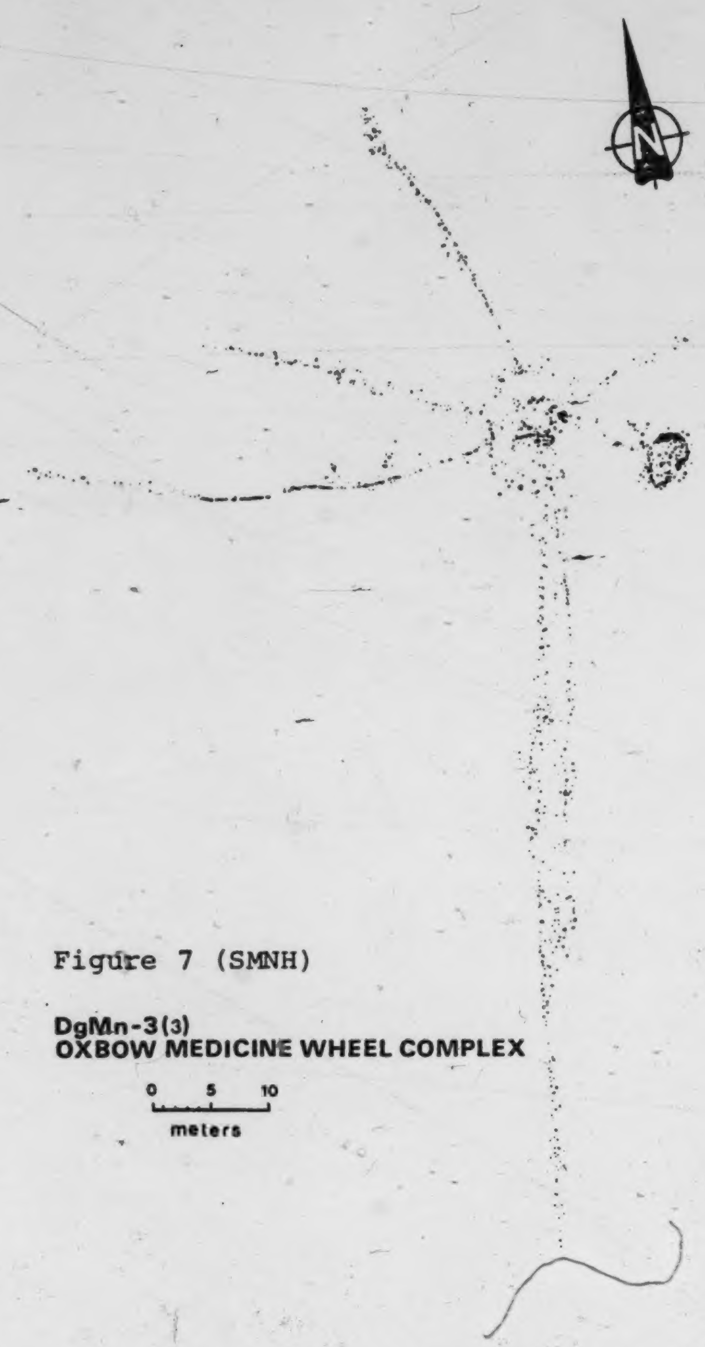


Figure 7 (SMNH)

DgMn-3(3)
OXBOW MEDICINE WHEEL COMPLEX

0 5 10
meters

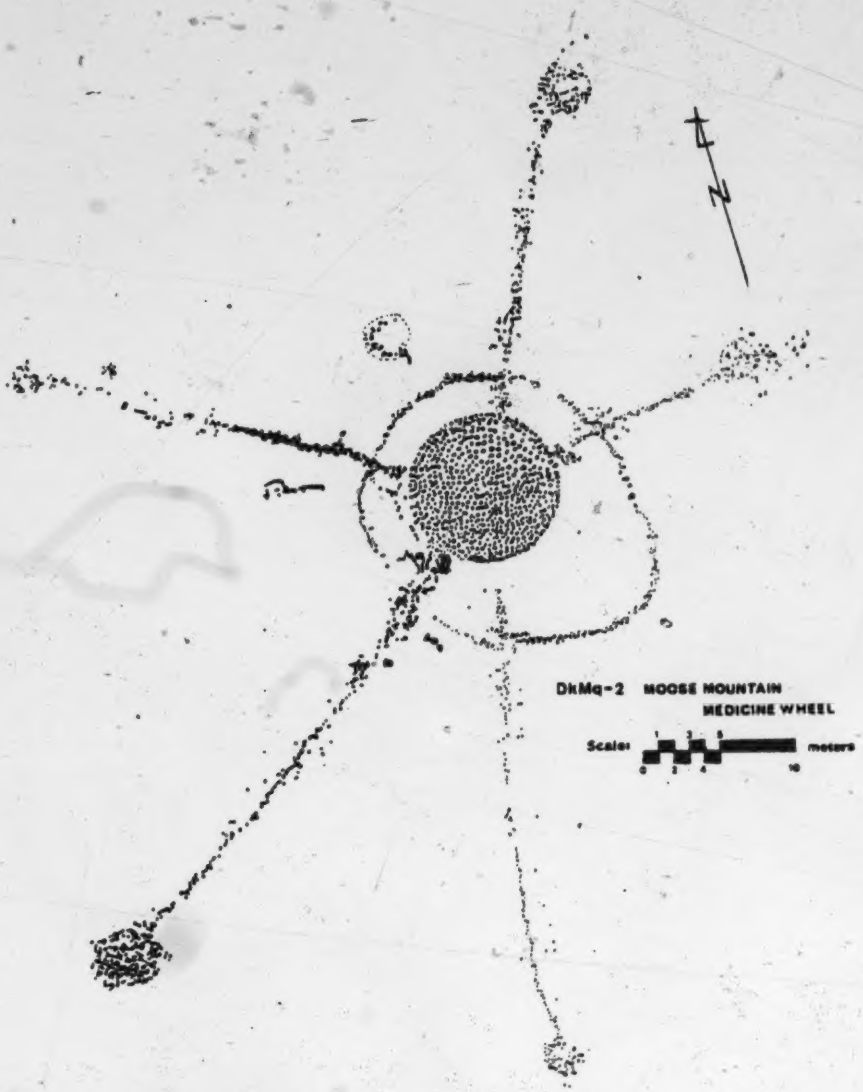

N
DkMq-2 MOOSE MOUNTAIN
MEDICINE WHEEL
Scale: 0 1 2 3 4 5 10 meters

Figure 8
(SMNH)

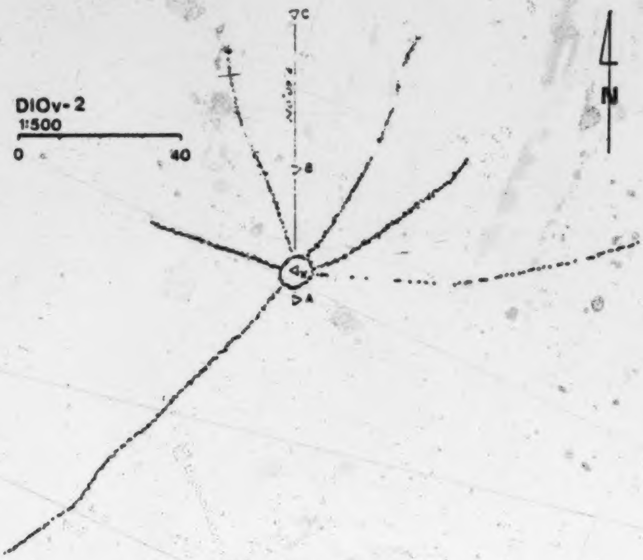

DlOv-2
1:500
0
40
C
B
A
N

Figure 9
Grassy Lake Medicine Wheel (ASA)

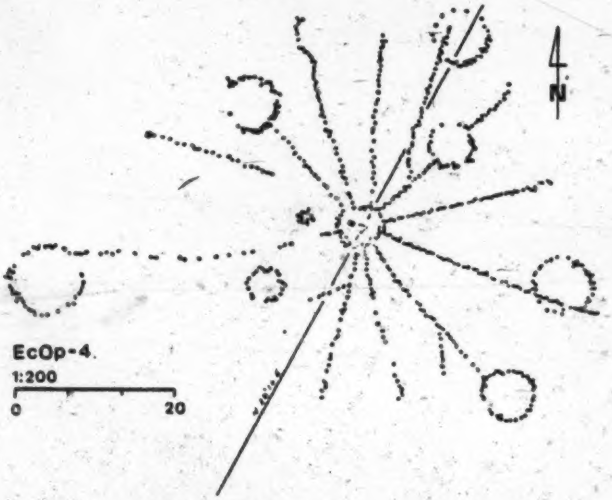

EcOp-4
1:200
0
20
N

Figure 10
Suffield Experimental Medicine Wheel
(ASA)

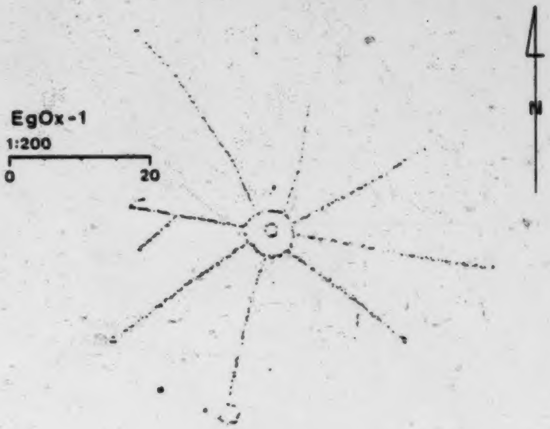

EgOx-1
1:200
0
20
N

Figure 11
Suitor Site No. 1 (ASA)

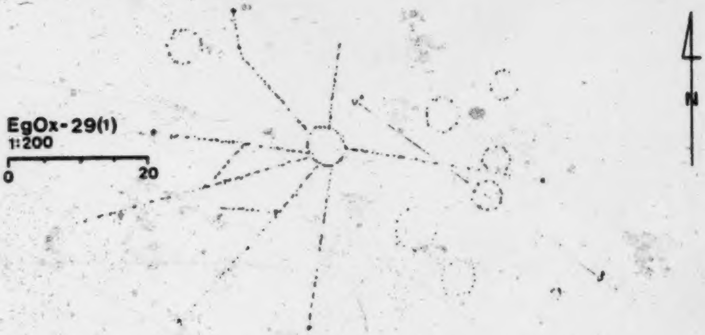

EgOx-29(1)
1:200
0
20
N

Figure 12
Suitor Site No. 2, Wheel No. 1 (ASA)

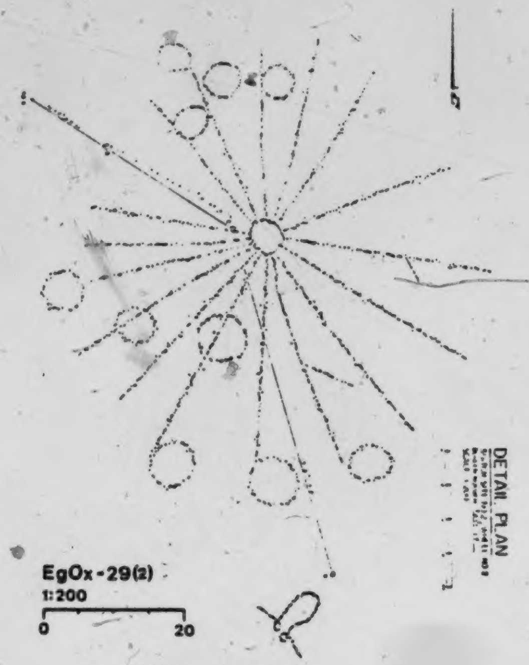

DETAIL PLAN
EgOx-29(2)
1:200
0
20

Figure 13
Suitor Site No. 2, Wheel No. 2
(ASA)

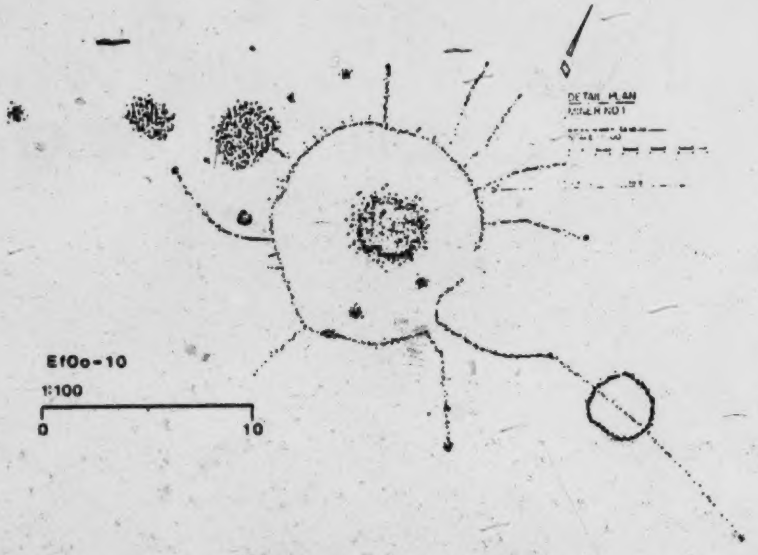

DETAIL PLAN
EfOo-10
1:100
0
10

Figure 14
Minor No. 1 (ASA)

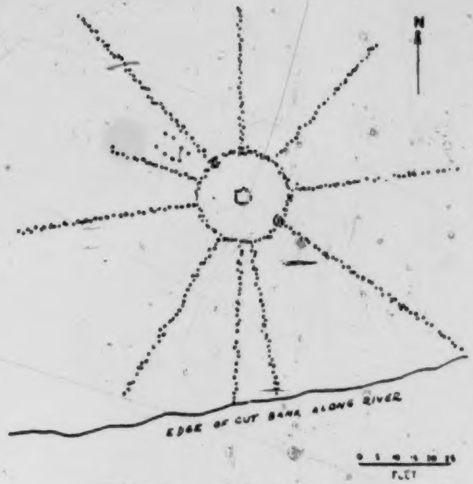

N
EDGE OF CUT BANK ALONG RIVER
0 5 10 15 20 25
FEET

Figure 15
Sun River Medicine Wheel
24TT67 (adapted after Kehoe 1954:135)

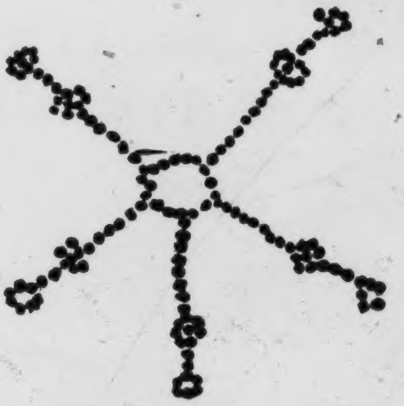


Figure 16
Custer County Boulder Outline
(adapted after Over 1941:48)

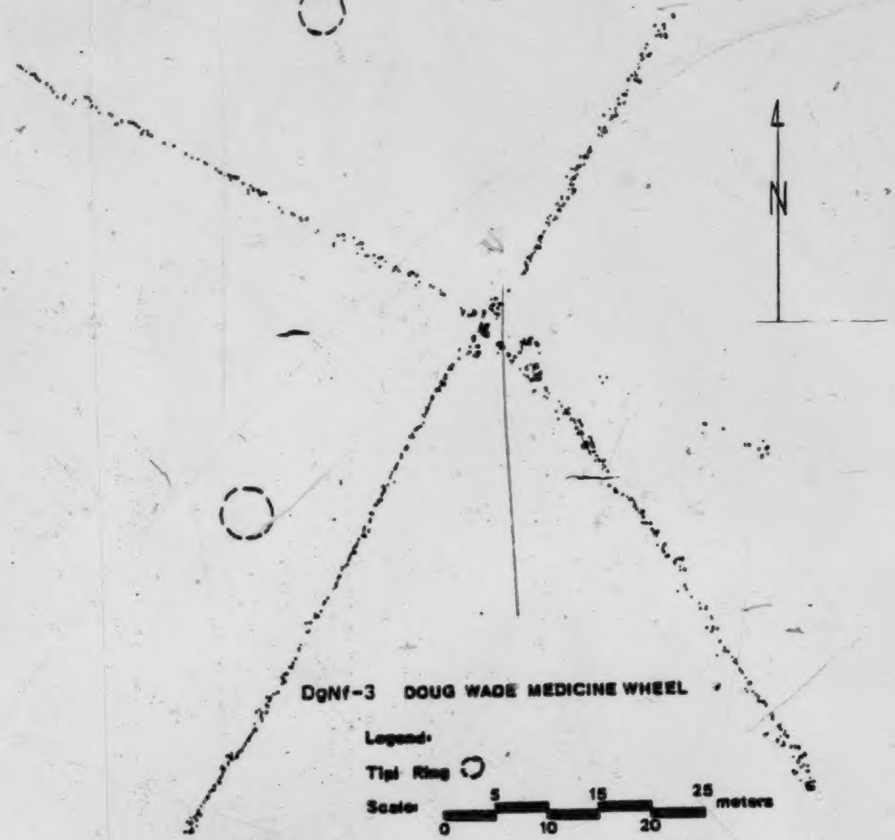

N
DgNf-3 DOUG WADE MEDICINE WHEEL
Legend:
Tipi Ring
Scale:
0
5
10
15
20
25
meters

Figure 17
(SMNH)

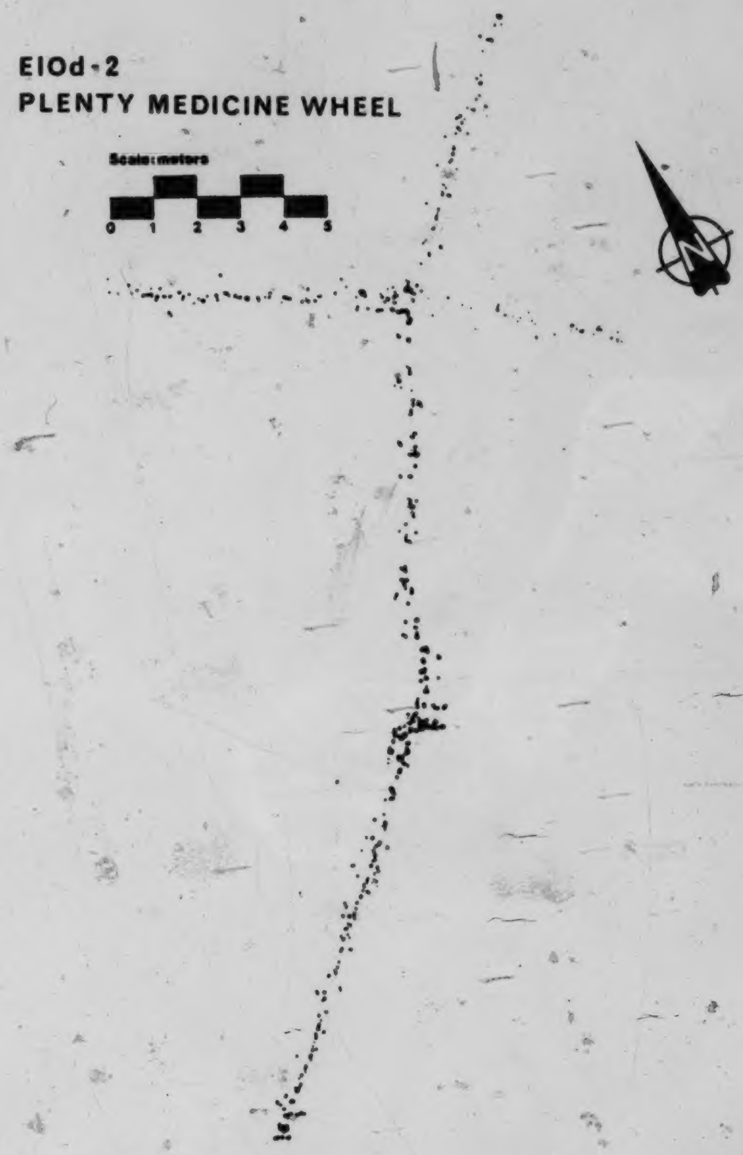

ElOd-2
PLENTY MEDICINE WHEEL
Scale: meters
0
1
2
3
4
5
N

Figure 18
(SMNH)

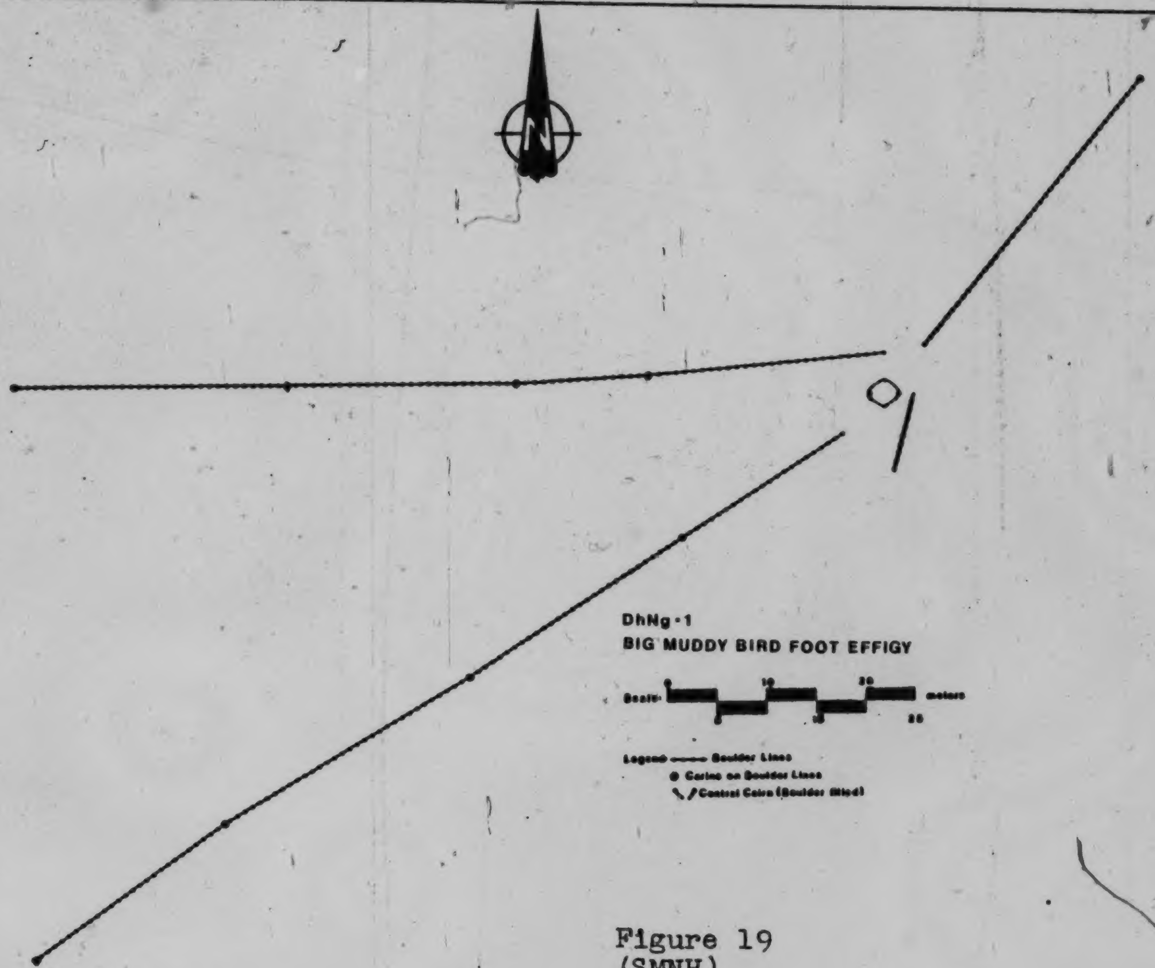

N
DhNg-1
BIG MUDDY BIRD FOOT EFFIGY
Scale
0
5
10
15
20
25
meters
Legend —— Boulder Lines
● Cairns on Boulder Lines
⟍ ⟋ Central Cairn (Boulder filled)

Figure 19
(SMNH)

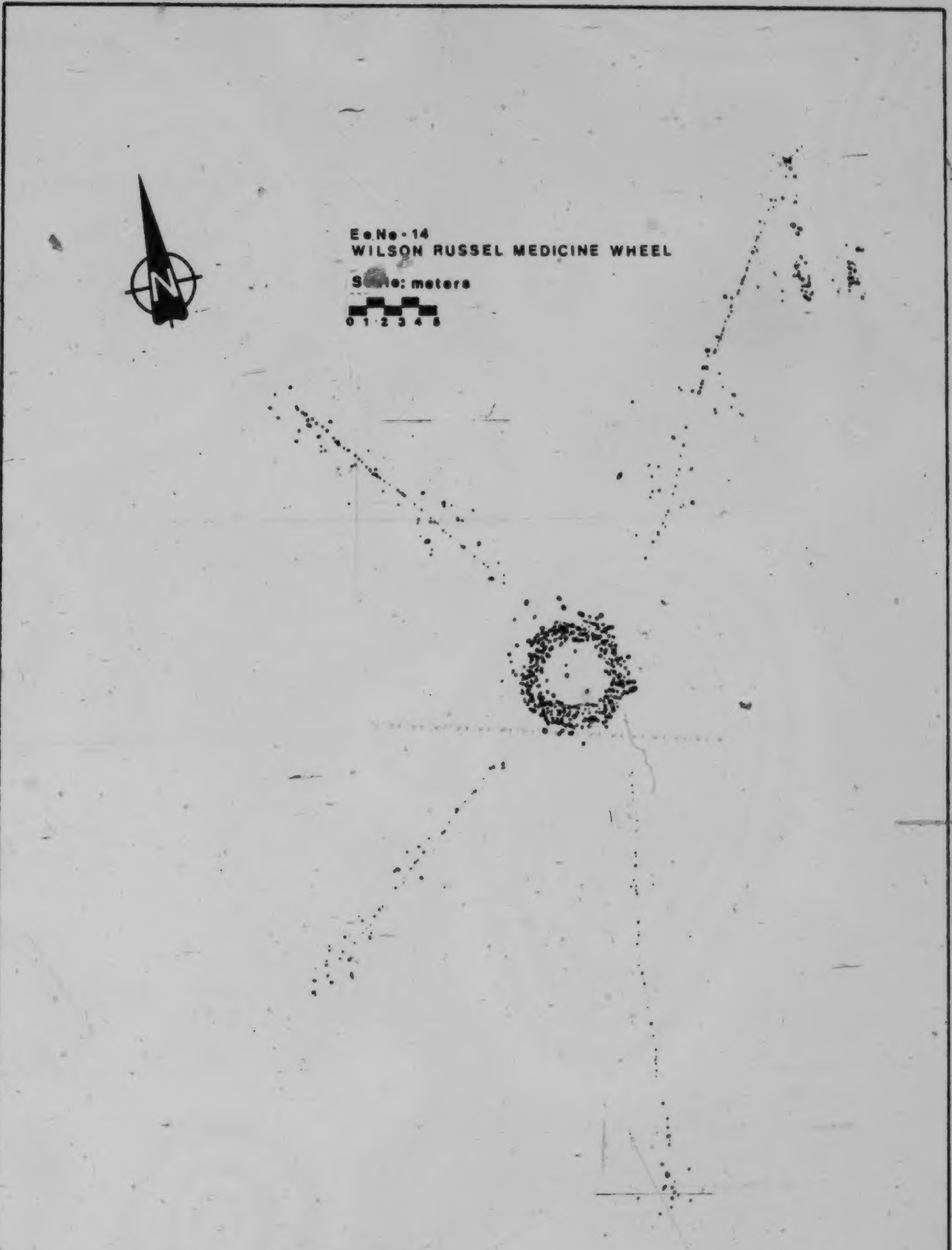

N
EeNe-14
WILSON RUSSEL MEDICINE WHEEL
Scale: meters
0 1 2 3 4 5

Figure 20
(SMNH)

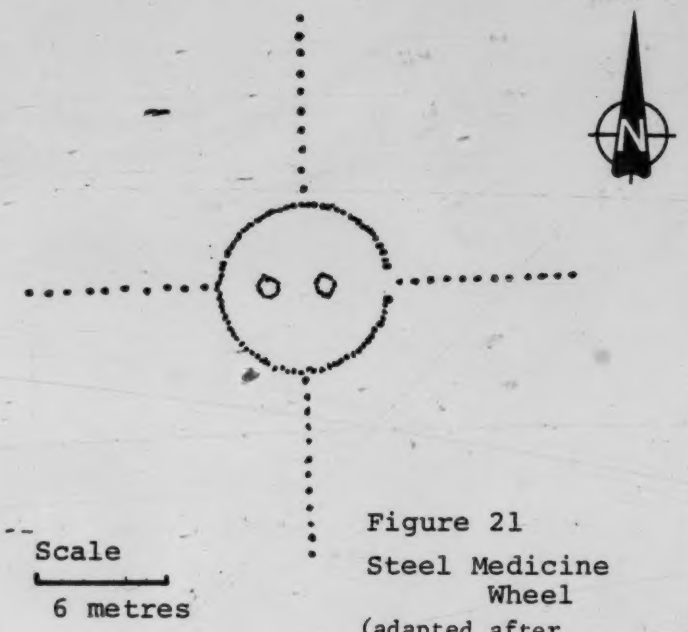

N
Scale
6 metres

Figure 21
Steel Medicine Wheel
(adapted after Dempsey 1956:198)

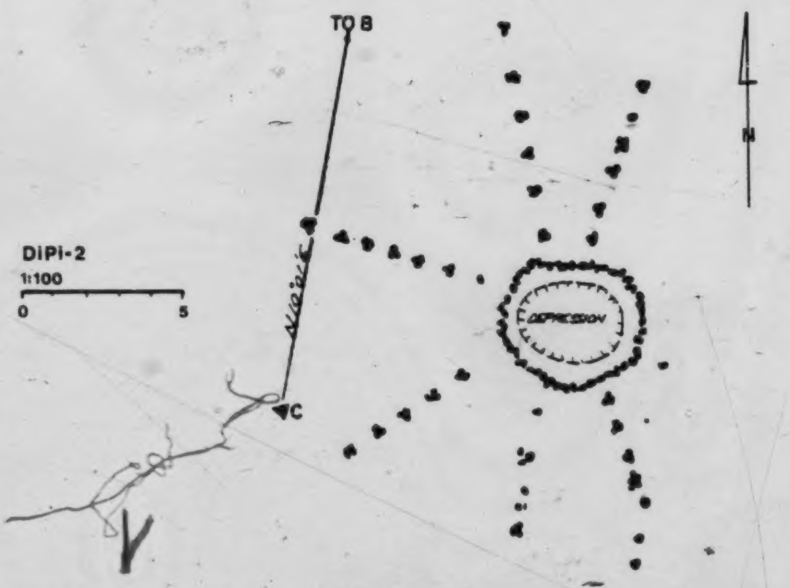

TO 8
DIPI-2
1:100
0
5
C
N
DEPRESSION

Figure 22
Wolfchild Medicine Wheel (ASA)

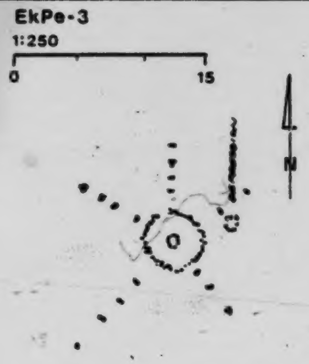

EkPe-3
1:250
0
15
N

Figure 23
Ziegenbein
Medicine Wheel
(ASA)

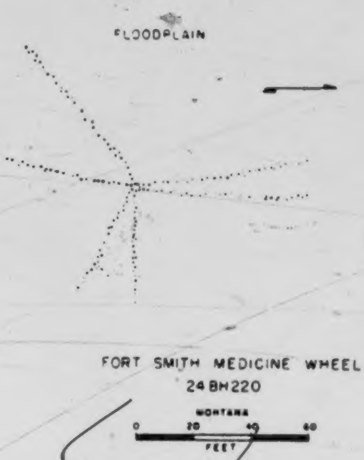
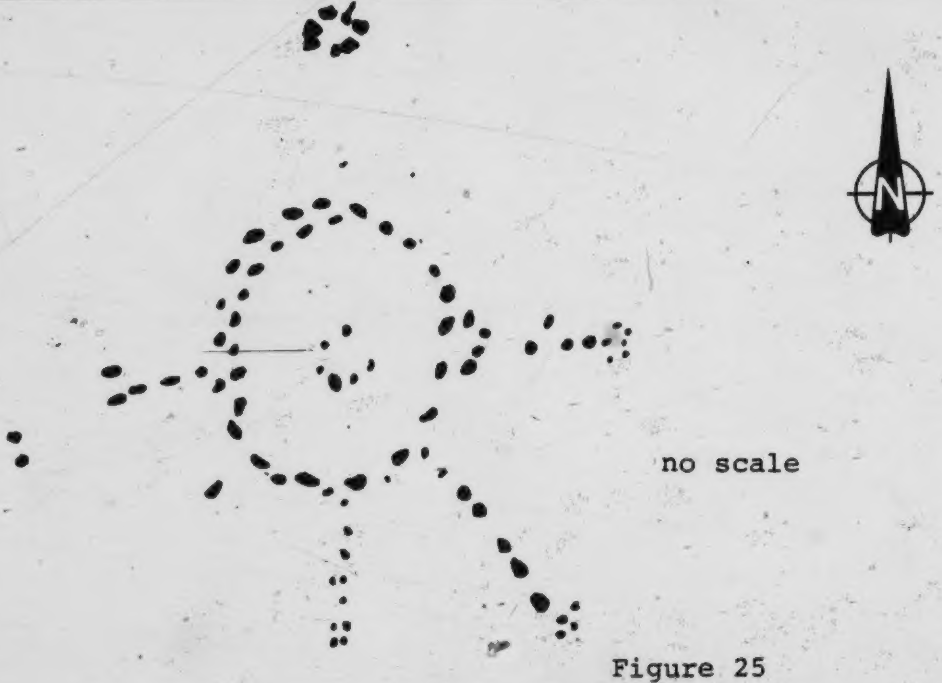

FLOODPLAIN
FORT SMITH MEDICINE WHEEL
24BH220
MONTANA
0
20
40
60
FEET

Figure 24
(adapted after
Brown 1963:229)



no scale

Figure 25
24BH747
(adapted after Quigg 1984)

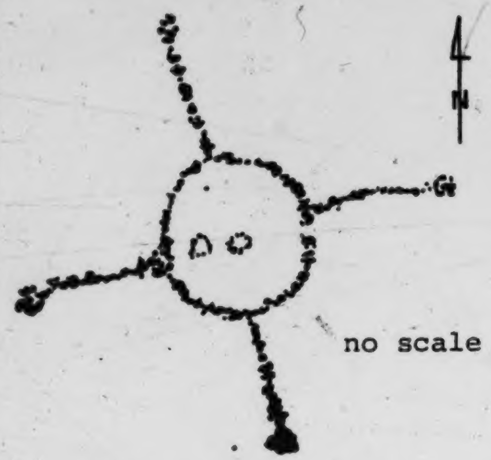


Figure 26 DkPf-1
(adapted after Quigg 1984)

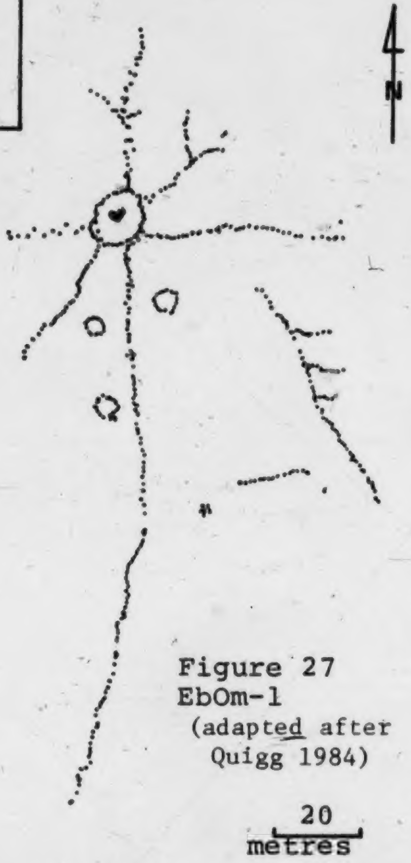


Figure 27
EbOm-1
(adapted after
Quigg 1984)

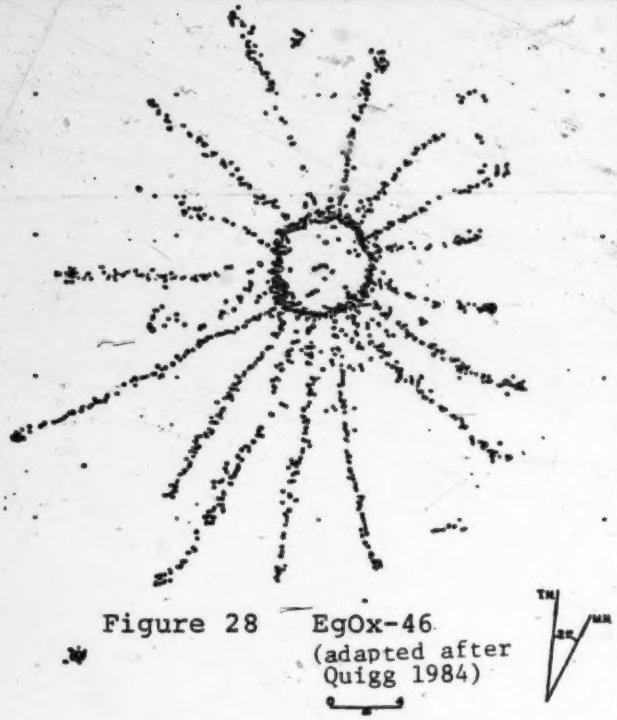
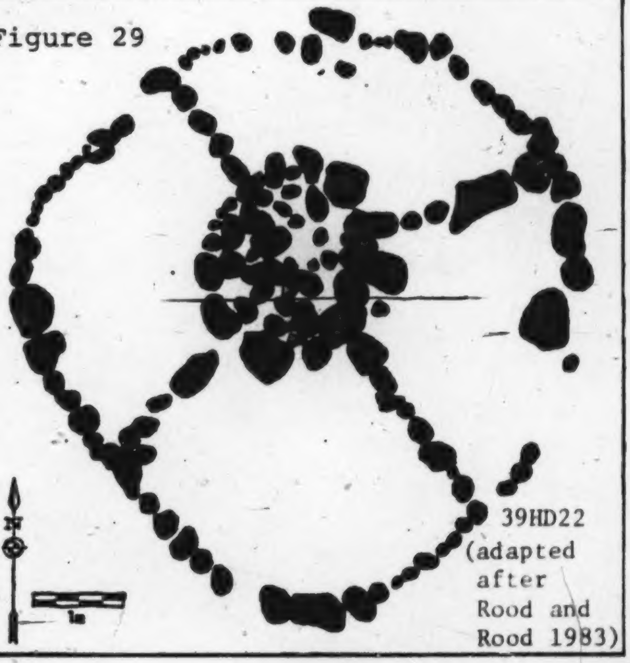


Figure 28 EgOx-46 (adapted after Quigg 1984)

Figure 29



39HD22 (adapted after Rood and Rood 1983)

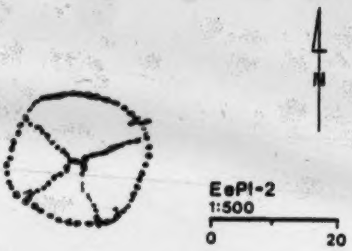

N
EePl-2
1:500
0
20

Figure 30 Jamieson's Place Medicine Wheel (ASA)

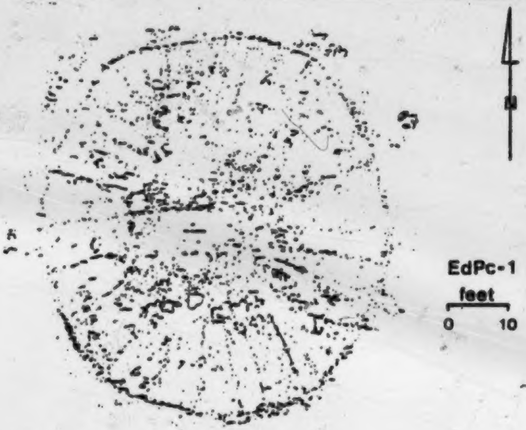

N
EdPc-1
feet
0
10

Figure 31 Majorville Cairn and Medicine Wheel
(adapted after Calder 1977:218)

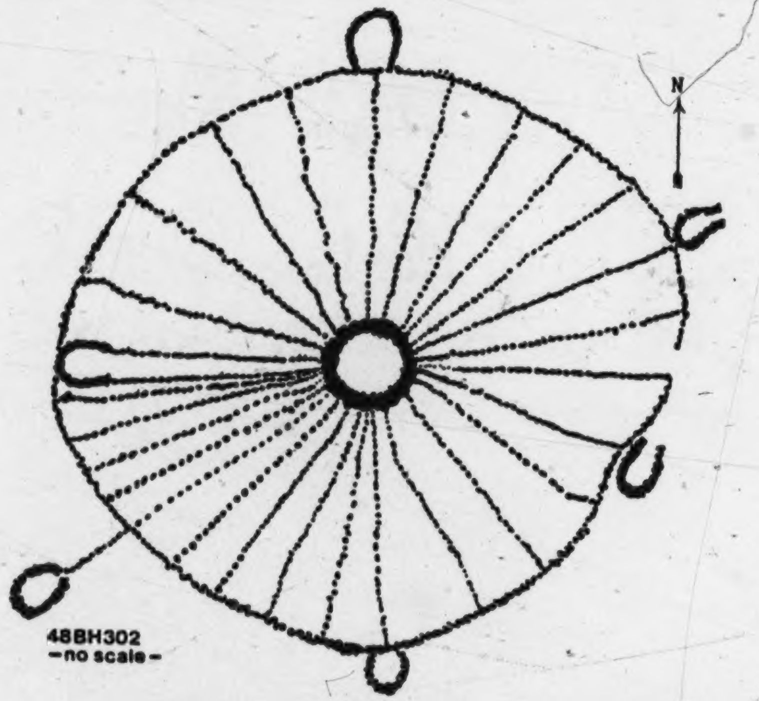

N
48BH302
-no scale-

Figure 32 Big Horn Medicine Wheel
(adapted after Grinnell 1922:302)

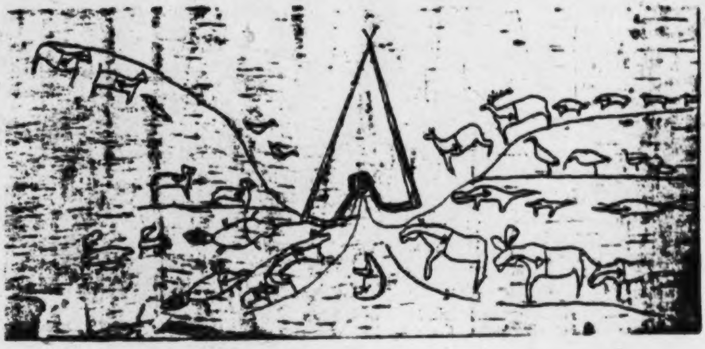
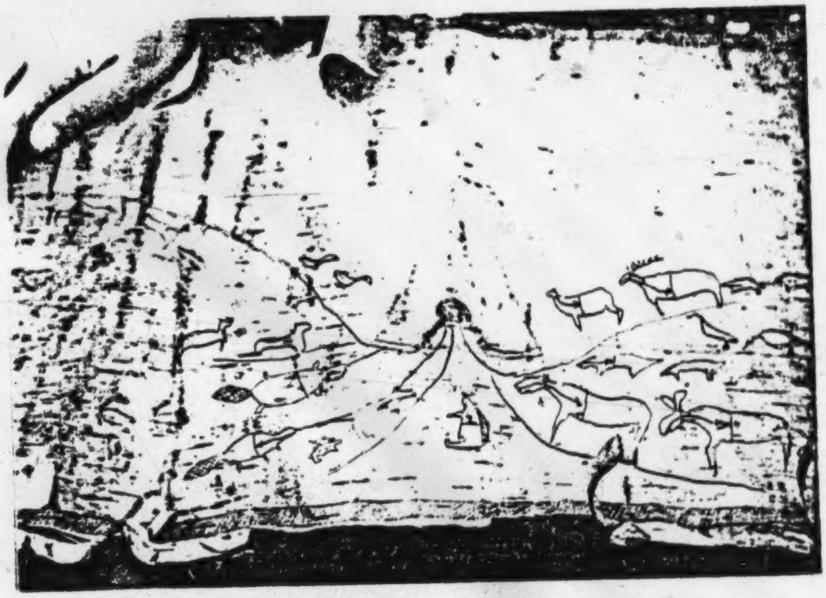


Figure 33 Birch Bark Scroll (Watson 1975: 21)



(Comparative photograph, different angle, better representation of bottom of scroll)

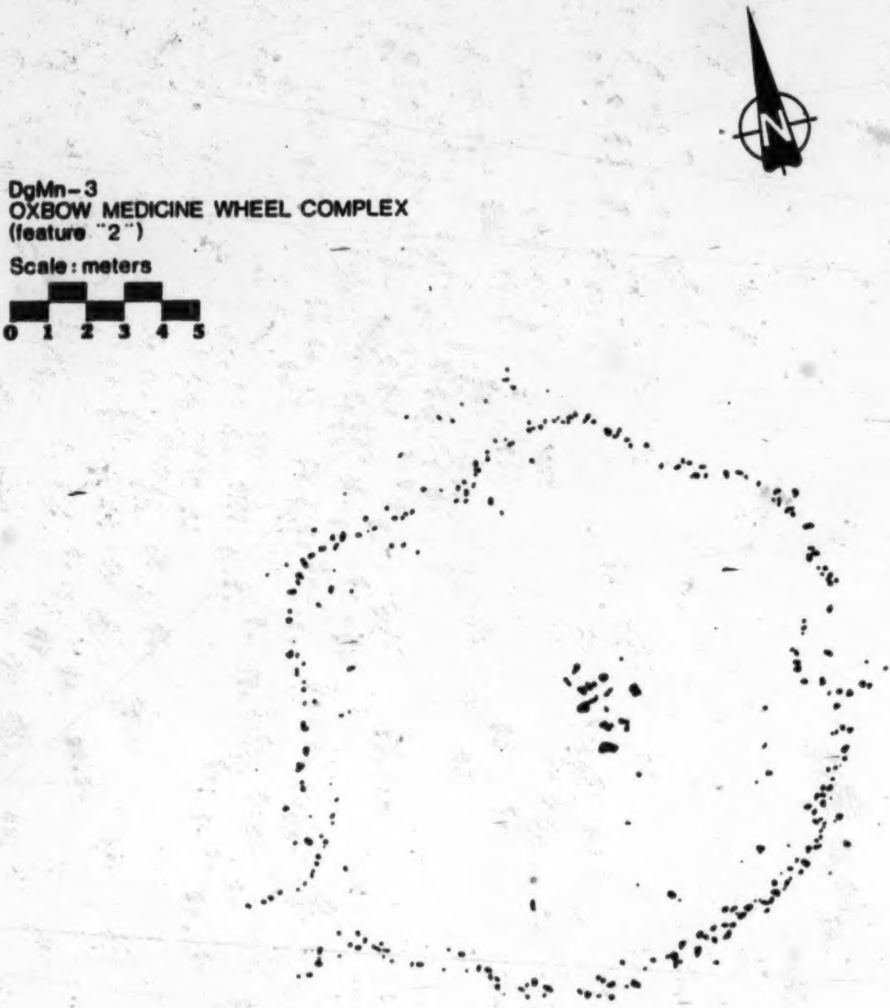
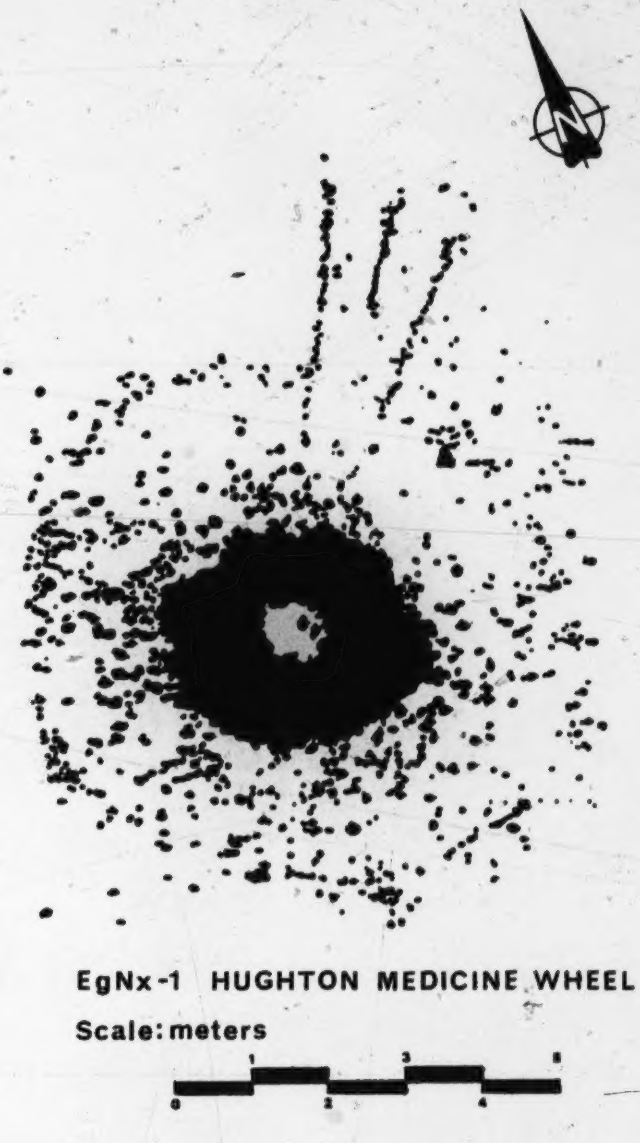

DgMn-3
OXBOW MEDICINE WHEEL COMPLEX
(feature "2")
Scale: meters
0 1 2 3 4 5
N

Figure 34 (SMNH)



EgNx-1 HUGHTON MEDICINE WHEEL

Scale: meters

Figure 35 (SMNH)

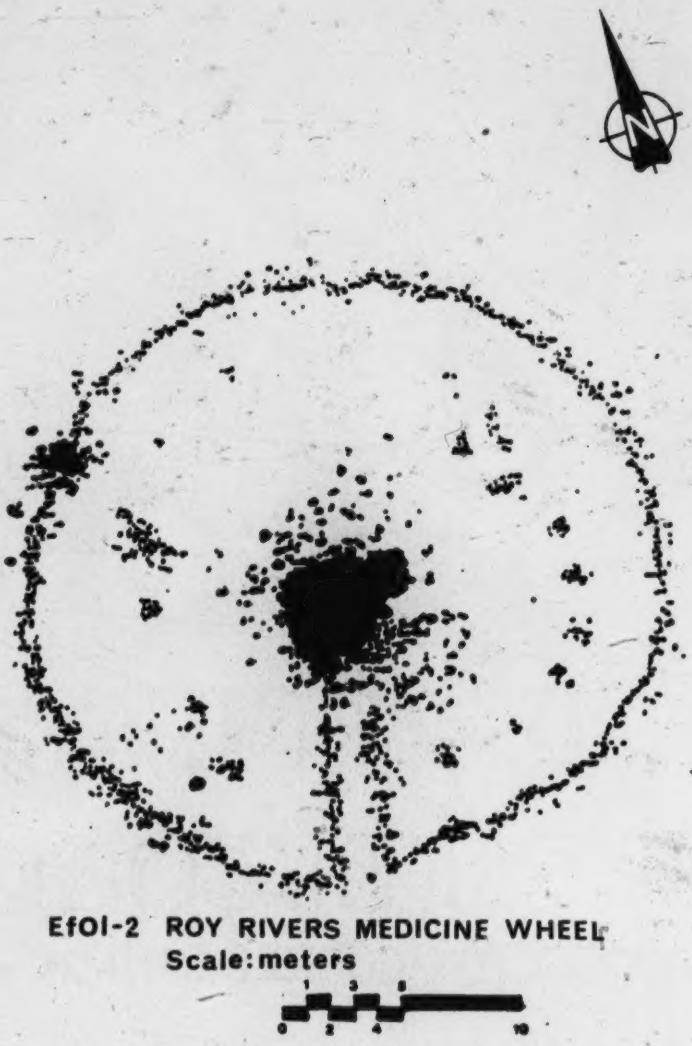

N
EfOl-2 ROY RIVERS MEDICINE WHEEL
Scale: meters
1
3
5
0
2
4
10

Figure 36 (SMNH)

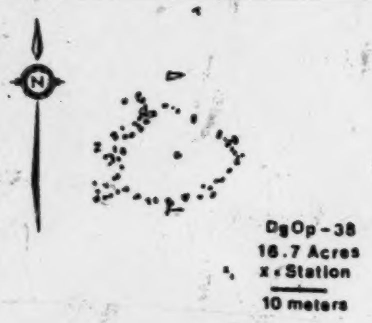

N
DgOp-38
16.7 Acres
x = Station
10 meters

Figure 37 (adapted after Graspointner 1980:62)

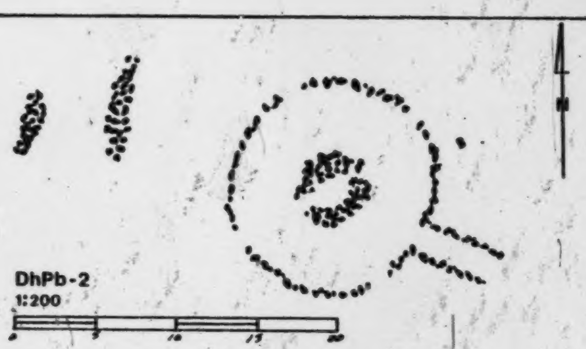

N
DhPb-2
1:200
0
5
10
15
20

Figure 38 Antelope Hill (ASA)

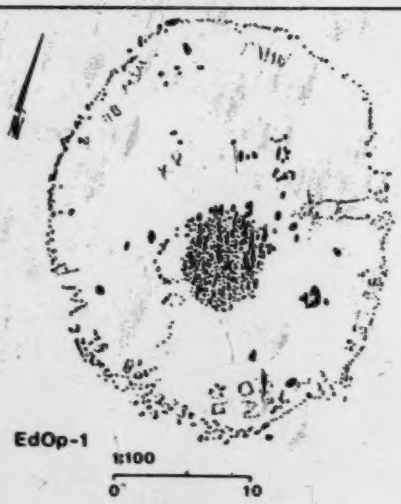

EdOp-1
1:100
0
10

Figure 39 British Block Cairn Medicine Wheel (ASA)

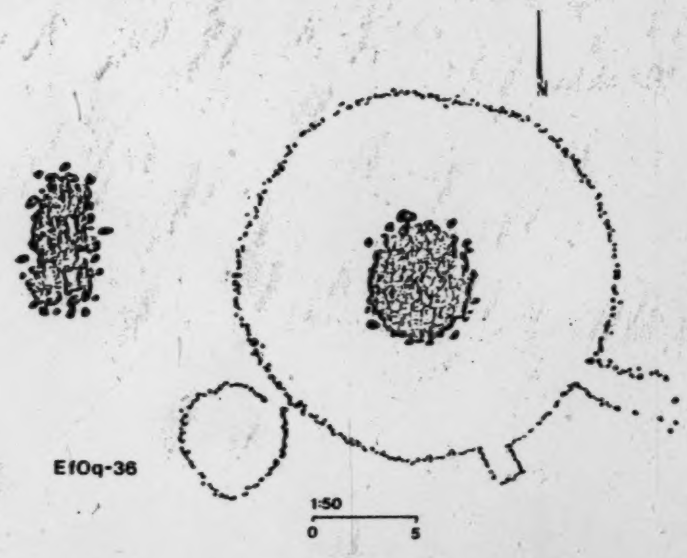

N
EfOq-36
1:50
0
5

Figure 40 Anderson No. 1 Medicine Wheel (ASA)

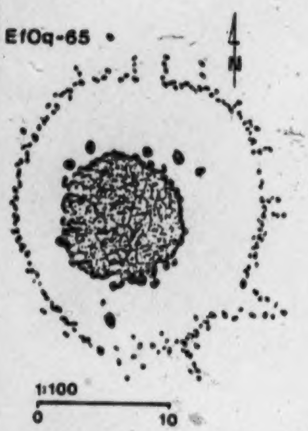

EfOq-65
N
1:100
0
10

Figure 41 Anderson No. 2 Medicine Wheel (ASA)

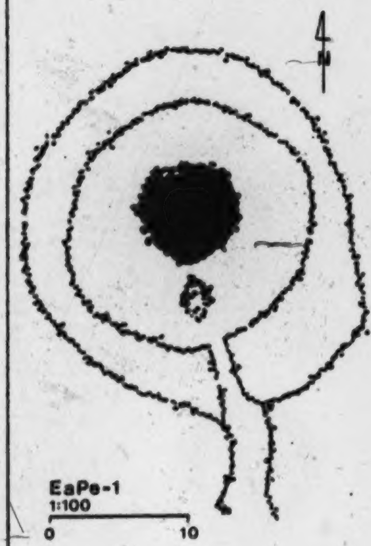

N
EaPe-1
1:100
0
10

Figure 42 Sundial Hill Medicine Wheel (ASA)

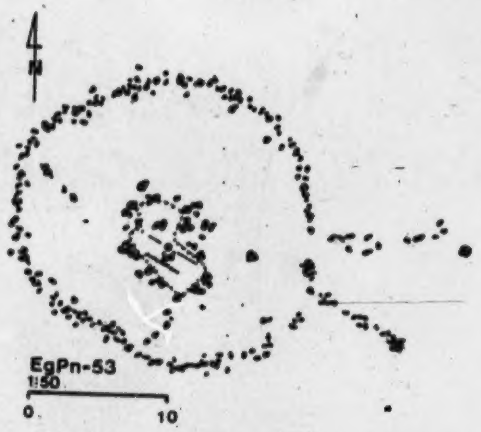

N
EgPn-53
1:50
0
10

Figure 43 Barry Medicine Wheel (ASA)

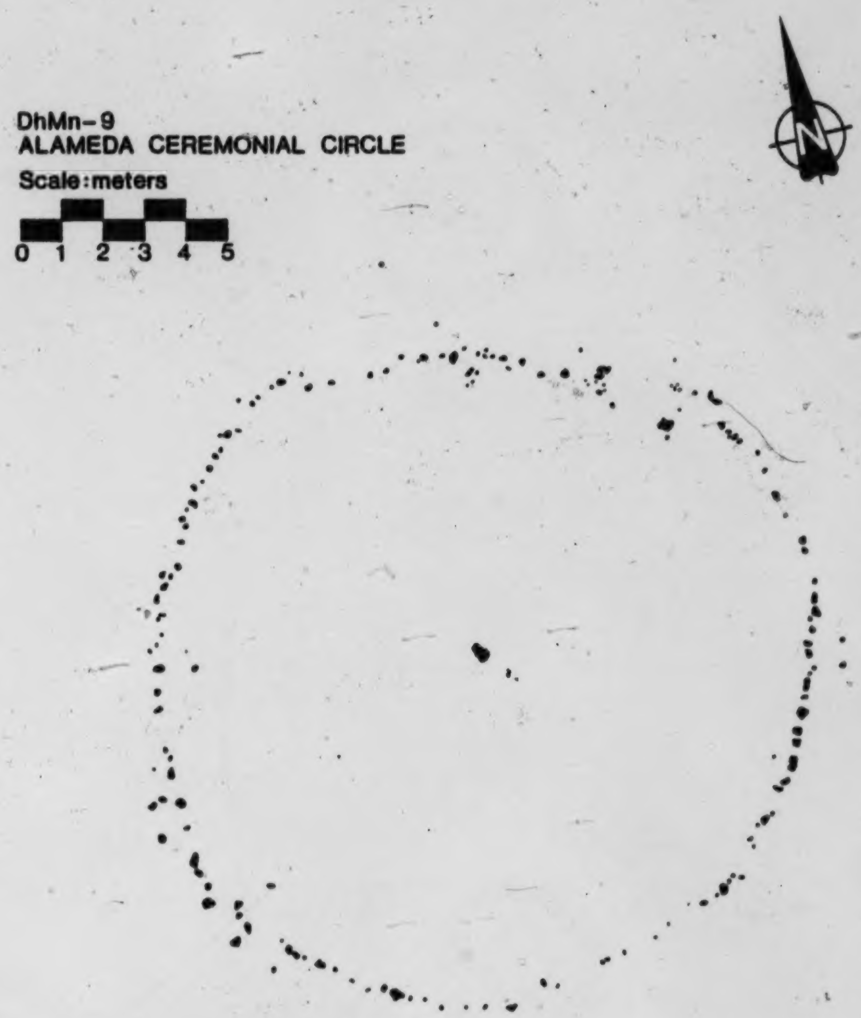

DhMn-9
ALAMEDA CEREMONIAL CIRCLE
Scale: meters
0 1 2 3 4 5
N

Figure 44 (SMNH)

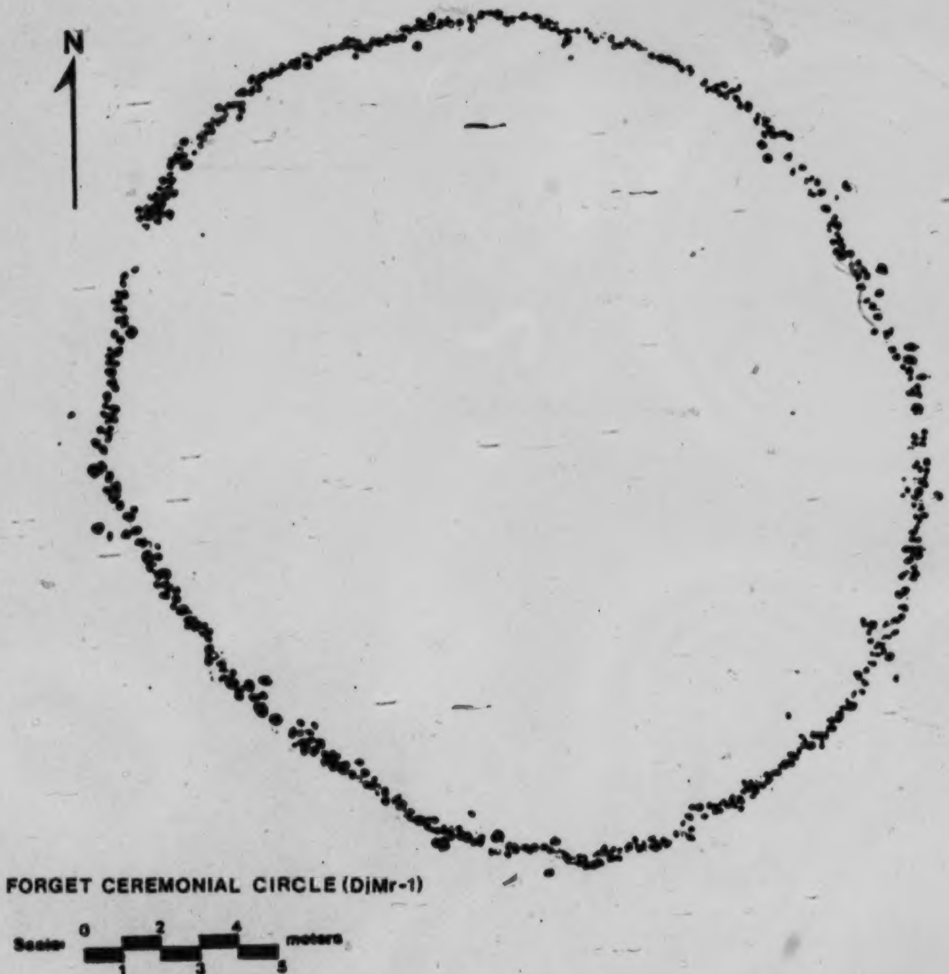

N
FORGET CEREMONIAL CIRCLE (DjMr-1)
Scale
0
1
2
3
4
5
meters

Figure 45 (SMNH)

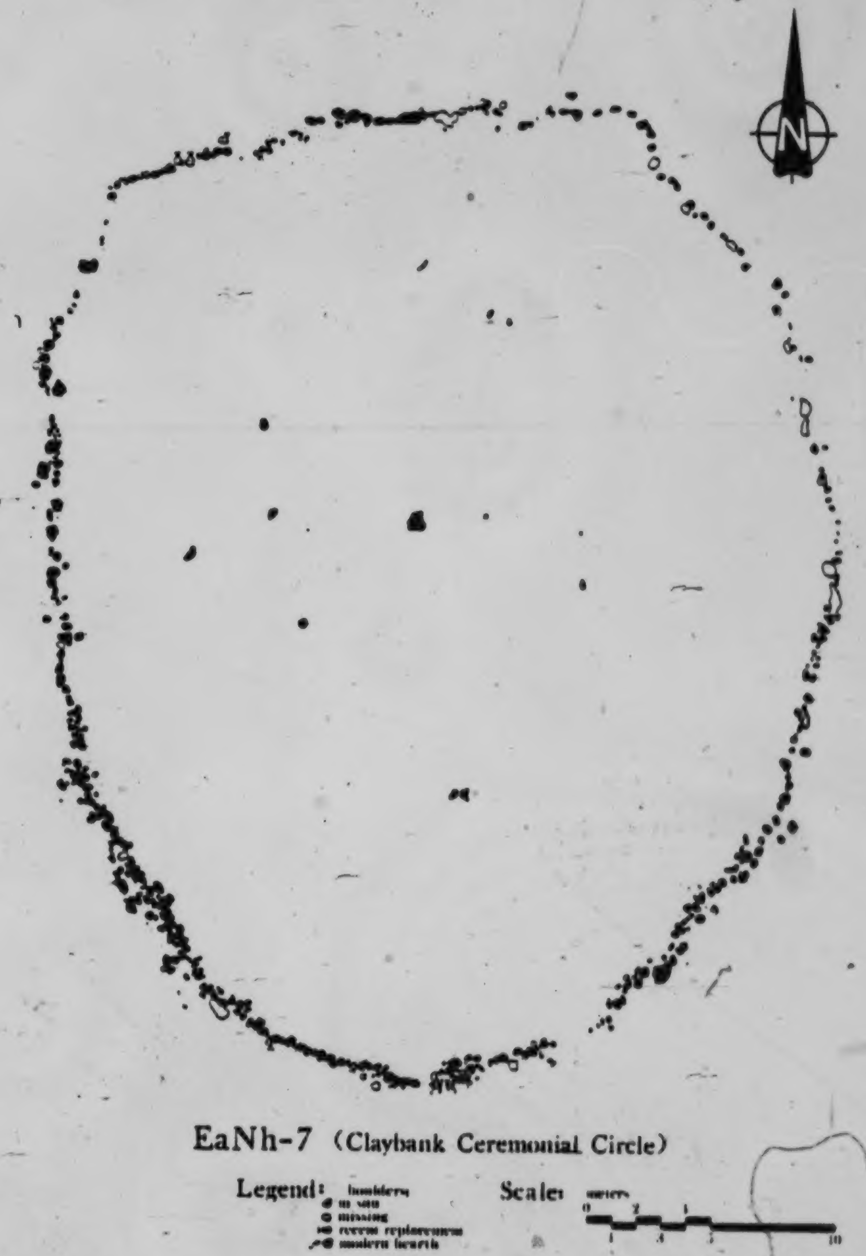

N
EaNh-7 (Claybank Ceremonial Circle)
Legend: boulders
in situ
missing
recent replacement
modern hearth
Scale: meters
0
2
4
1
3
5
10

Figure 46 (SMNH)

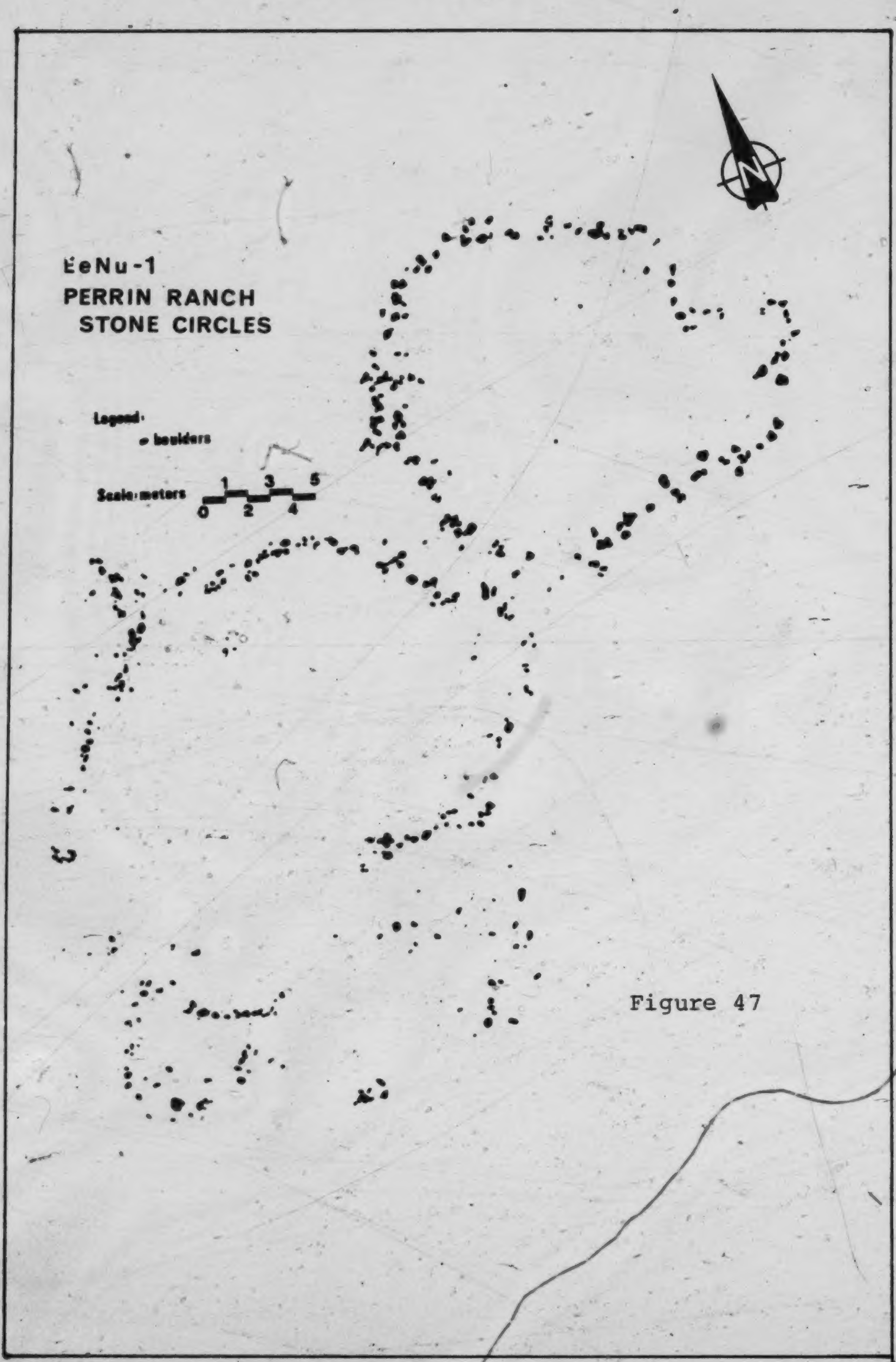

EeNu-1
PERRIN RANCH
STONE CIRCLES
Legend:
boulders
Scale: meters
0
1
2
3
4
5
N

Figure 47

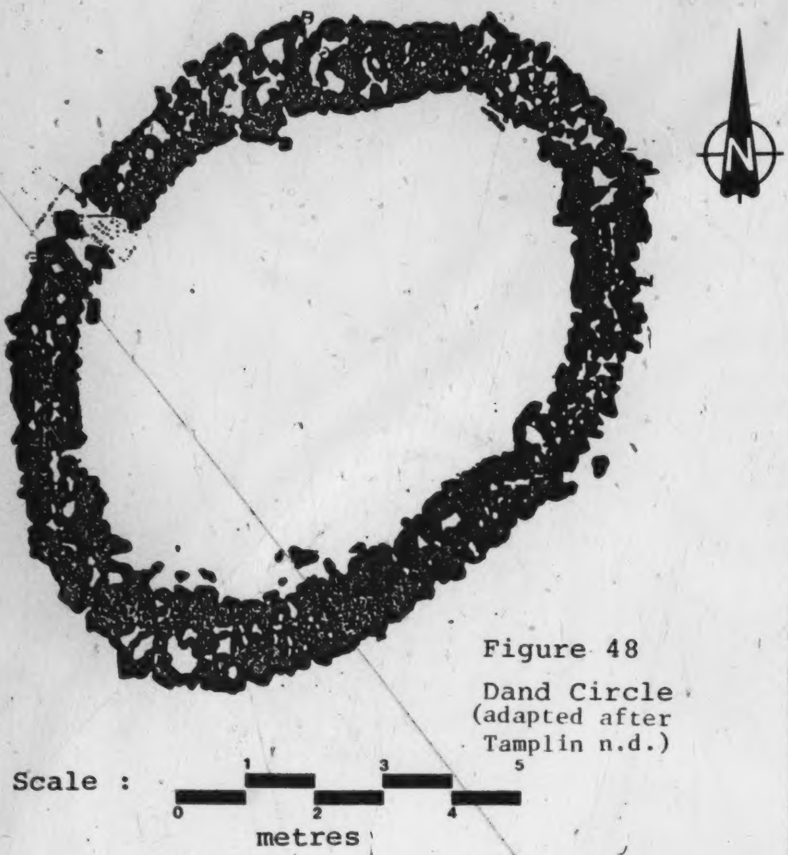

N
Scale :
0
1
2
3
4
5
metres

Figure 48

Dand Circle
(adapted after
Tamplin n.d.)

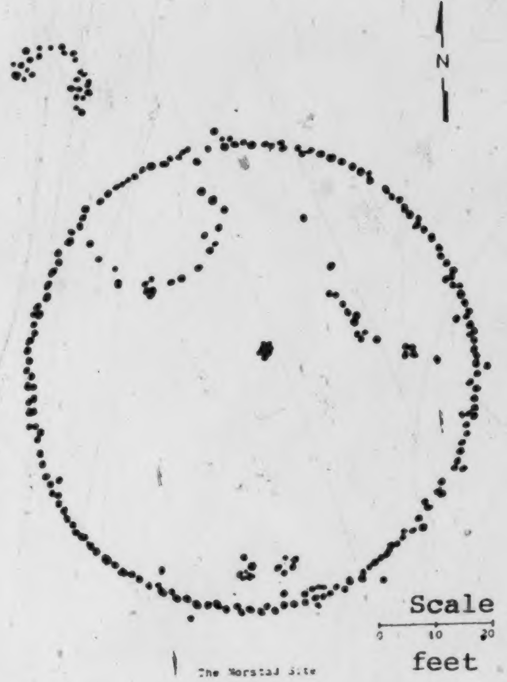

N
Scale
0
10
20
feet
The Morstad Site

Figure 49 Morstad Site

(adapted after
Jerde 1959:22)

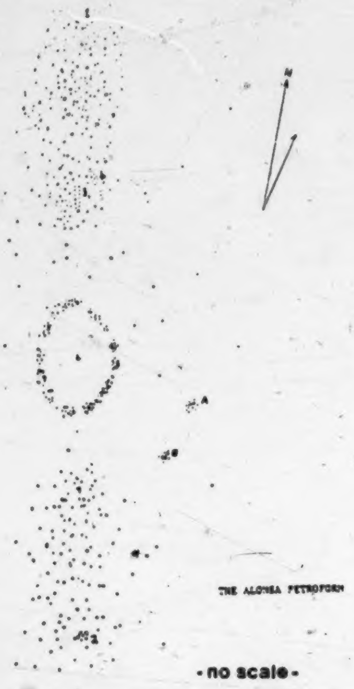

N
THE ALONSA PETROFORM
- no scale -

Figure 50
Alonsa Site
(adapted after Rutkowski and Westcott 1979)

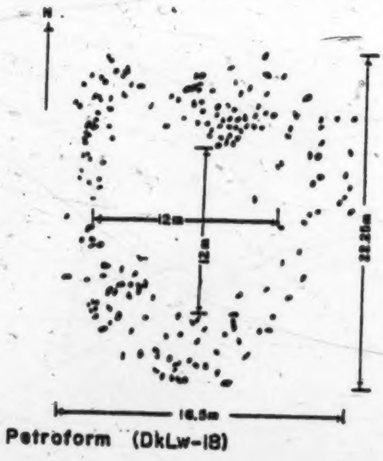

N
12m
12m
22.25m
16.5m
Petroform (DkLw-18)

Figure 51
Petroform
(adapted after Nicholson 1980)

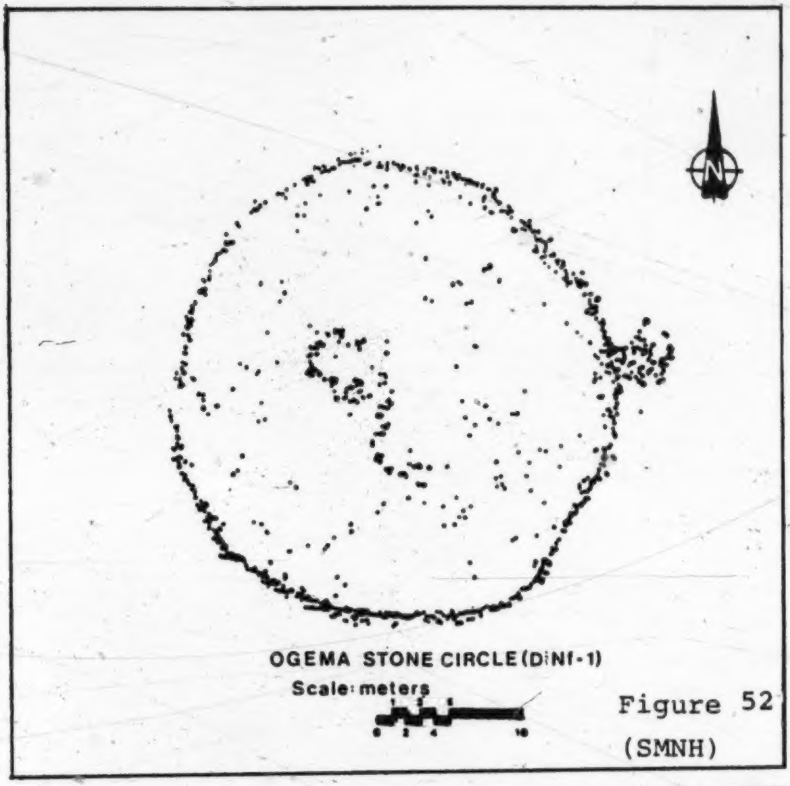

N
OGEMA STONE CIRCLE (DiNf-1)
Scale: meters
1
3
5
0
2
4
10

Figure 52
(SMNH)

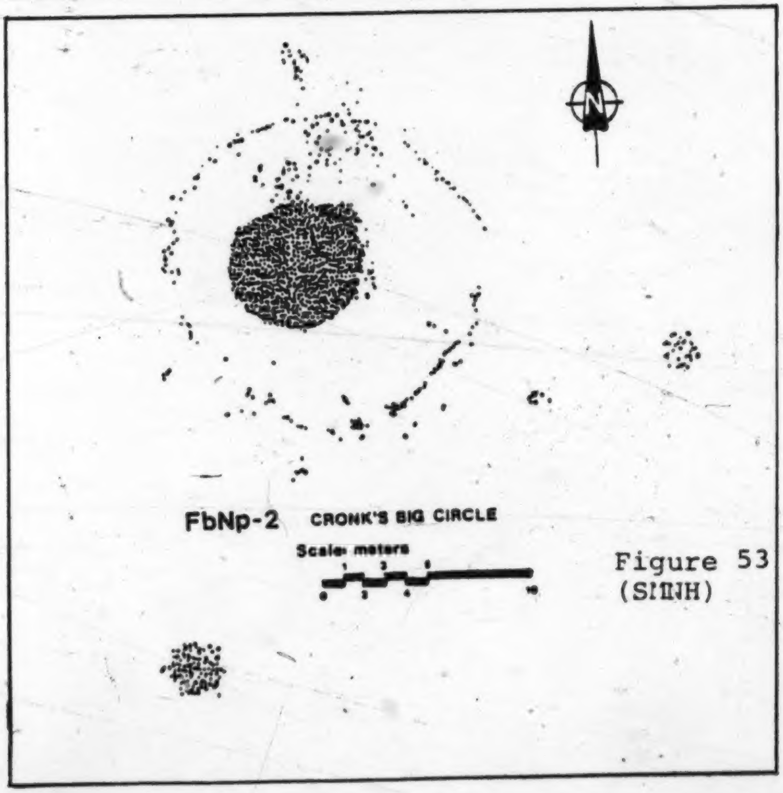

N
FbNp-2
CRONK'S BIG CIRCLE
Scale: meters
1
3
5
0
2
4
10

Figure 53
(SMNH)

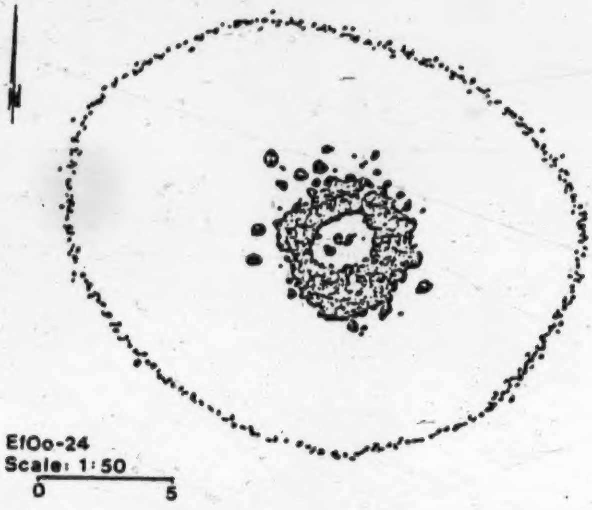

N
EfOo-24
Scale: 1:50
0
5

Figure 54 Minor No. 3 Medicine Wheel (ASA)

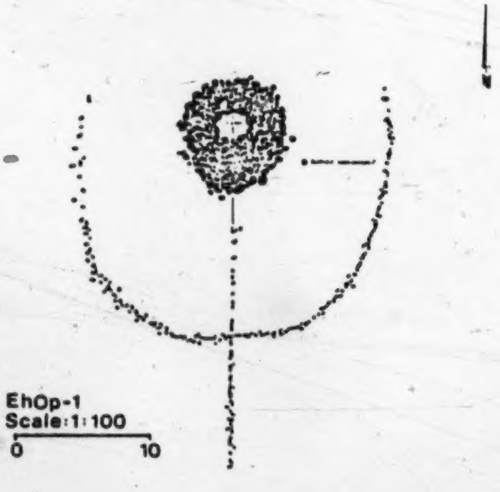

N
EhOp-1
Scale:1:100
0
10

Figure 55 Buffalo Bird Medicine Wheel (ASA)

Figure 56

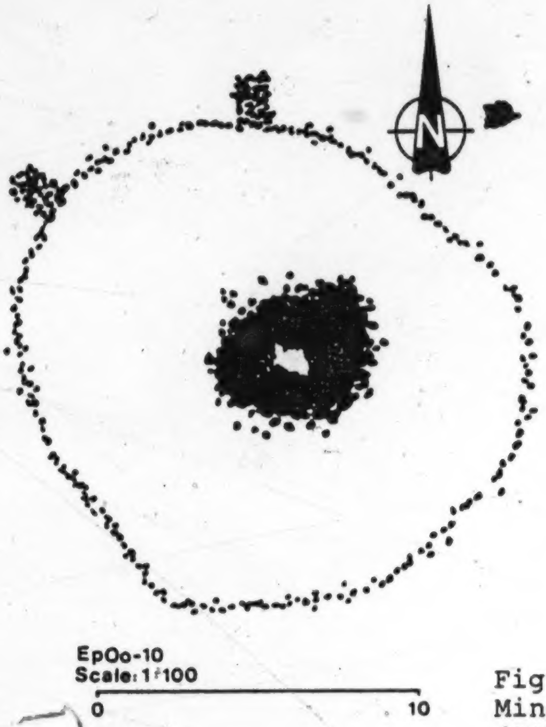

N
EpOo-10
Scale: 1:100
0
10

Figure 56
Minor No. 2
(ASA)

Figure 57

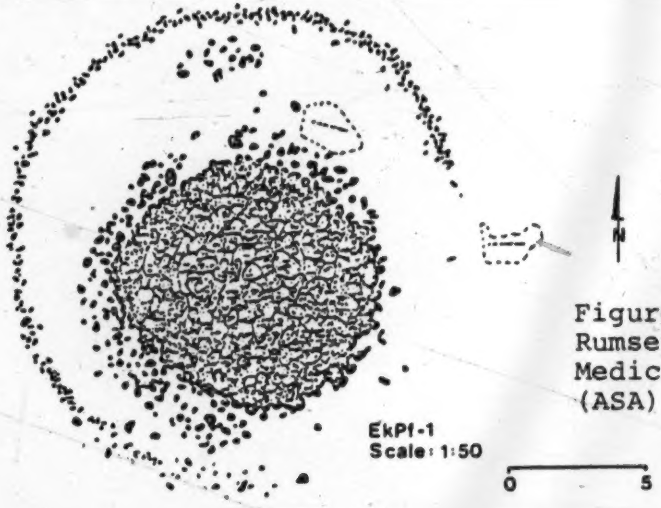
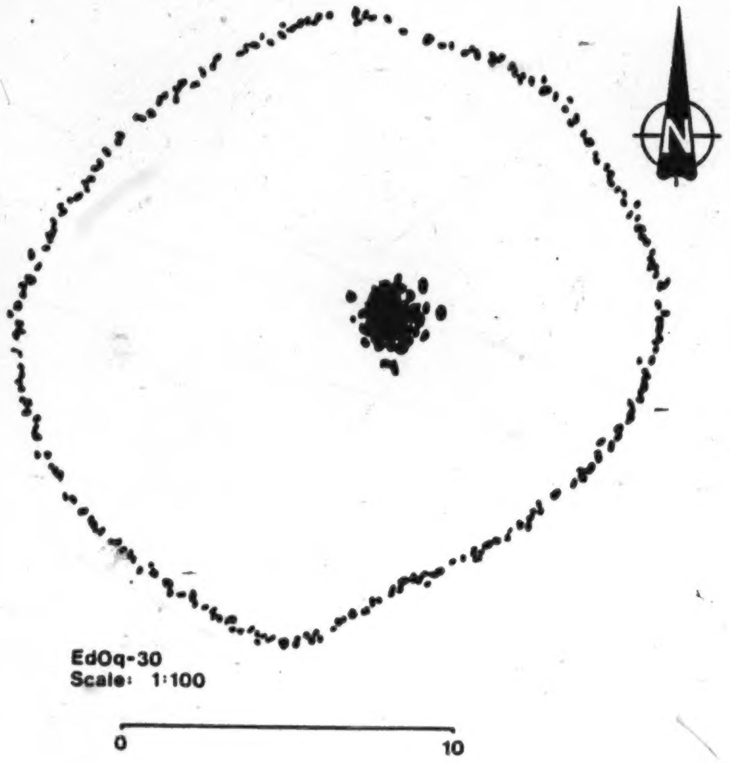

N
EkPf-1
Scale: 1:50
0
5

Figure 57
Rumsey Cairn &
Medicine Wheel
(ASA)



EdOq-30
Scale: 1:100
0
10
N

Figure 58 Byrne's M40 Medicine Wheel (ASA)

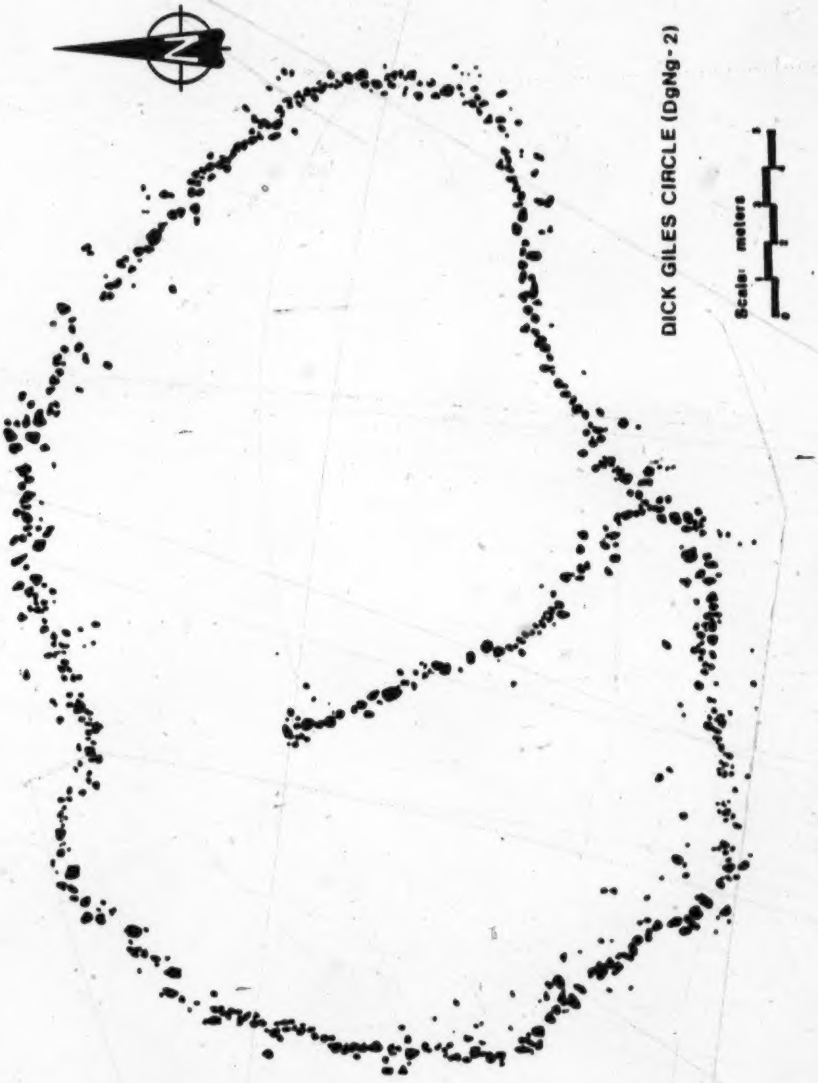

N
DICK GILES CIRCLE (DgNg-2)
Scale: meters

Figure 59
(SMNH)

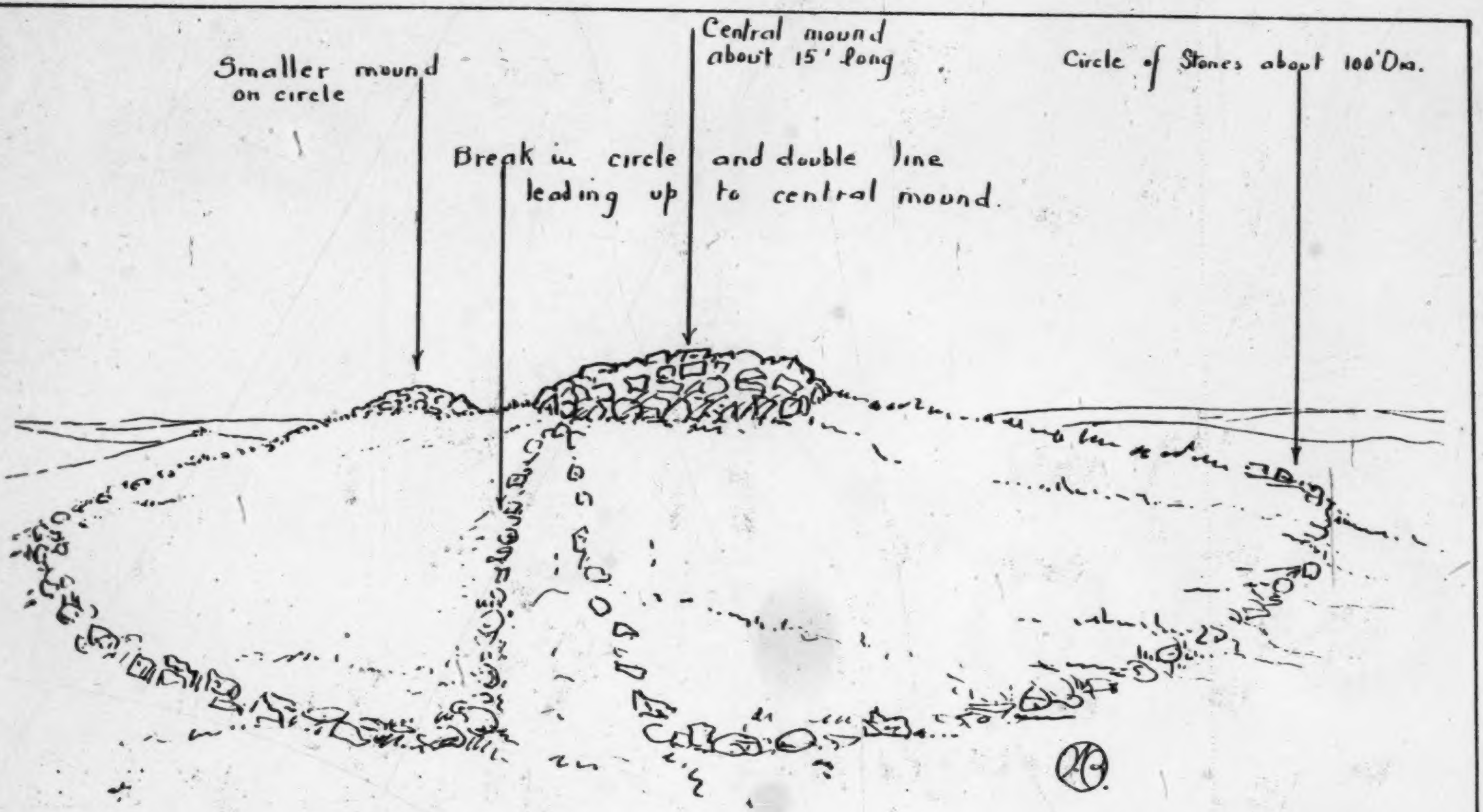

Smaller mound on circle
Central mound about 15' long
Circle of Stones about 100'Dia.
Break in circle and double line leading up to central mound.

Figure 60
Roy Rivers Medicine Wheel (1915) (Begg 1915:1)

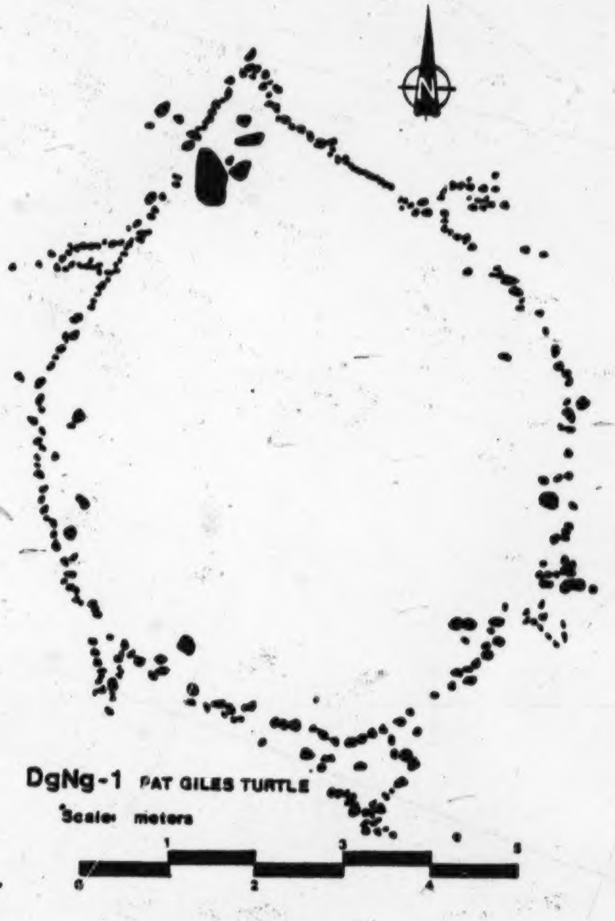

N
DgNg-1 PAT GILES TURTLE
Scale: meters
0
1
2
3
4
5

Figure 61
(SMNH)

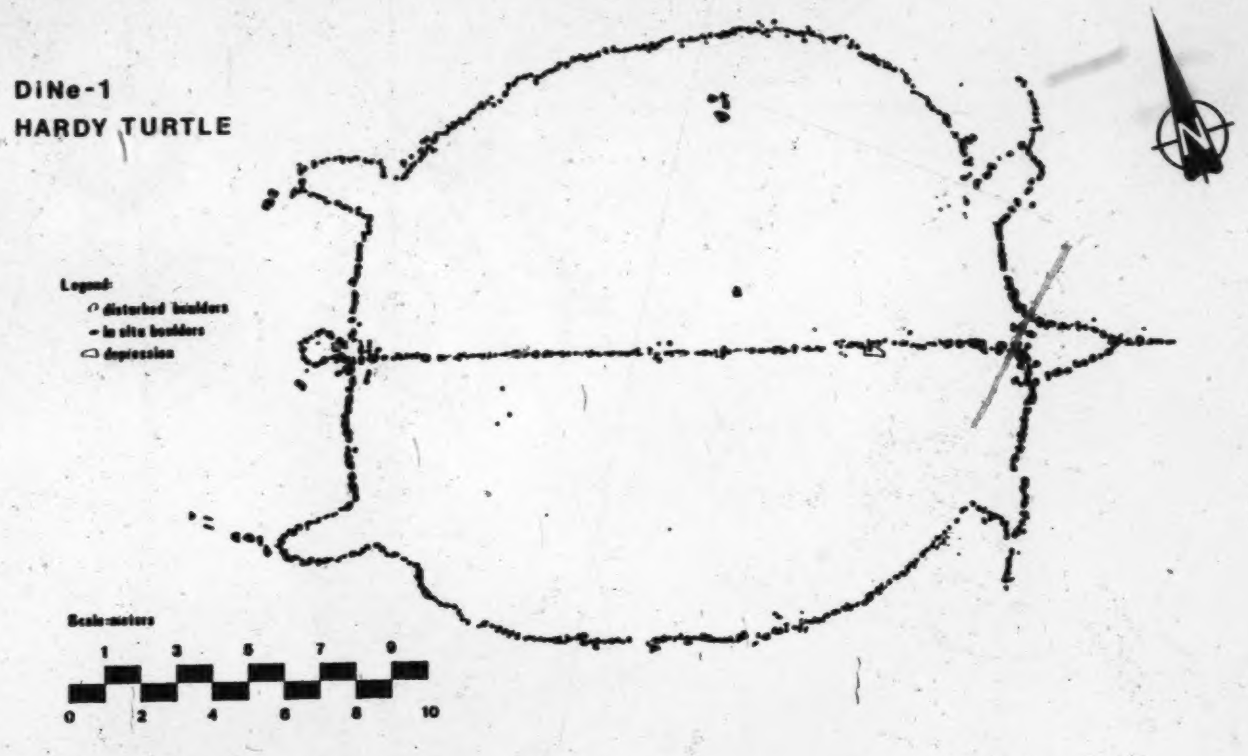

DiNe-1
HARDY TURTLE
Legend:
∩ disturbed boulders
• in situ boulders
◁ depression
Scale-meters
0
1
2
3
4
5
6
7
8
9
10
N

Figure 62
(SMNH)

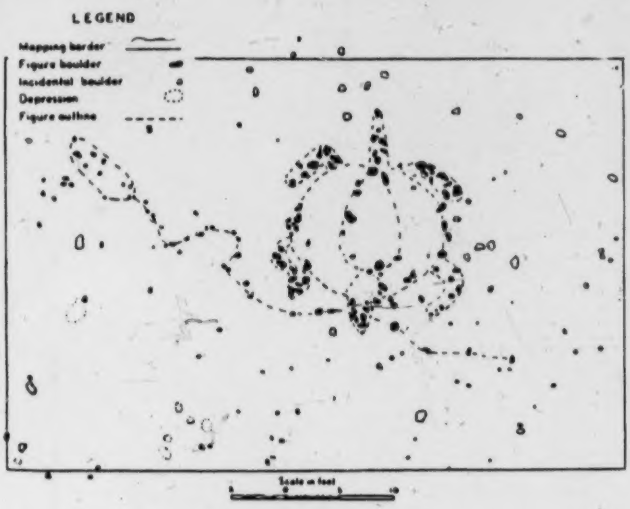

LEGEND
Mapping border
Figure boulder
Incidental boulder
Depression
Figure outline
Scale in feet

Figure 63
Consort Turtle and Snake
(adapted after Bayrock 1965)

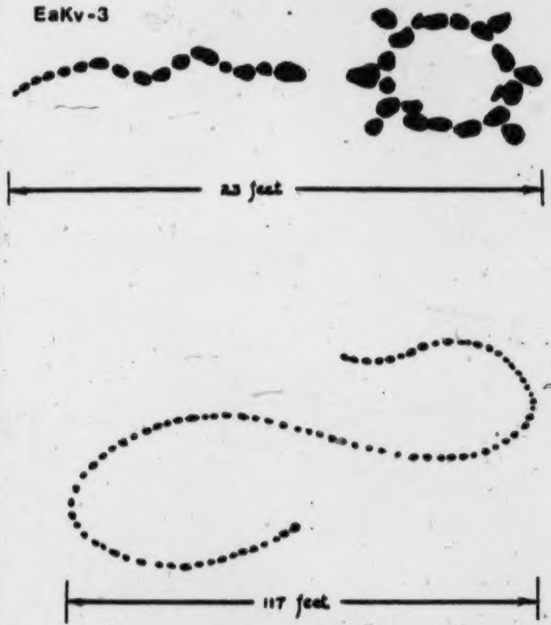

EaKv-3
23 feet
117 feet

Figure 64
Bannock Point Site
(adapted after Sutton 1965)

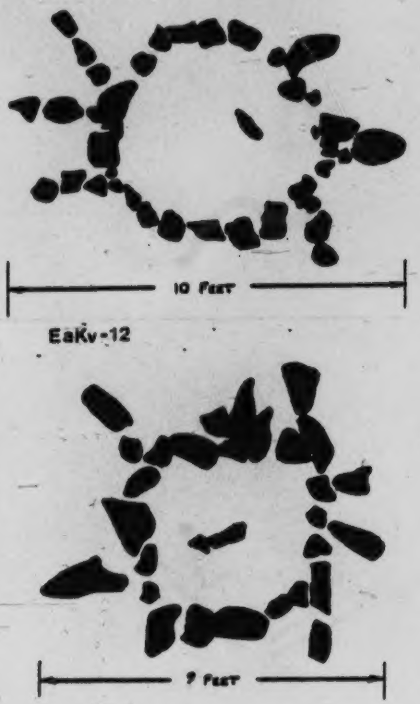

10 FEET
EaKv-12
9 FEET

Figure 65
Rainbow Falls (adapted after Sutton 1965)

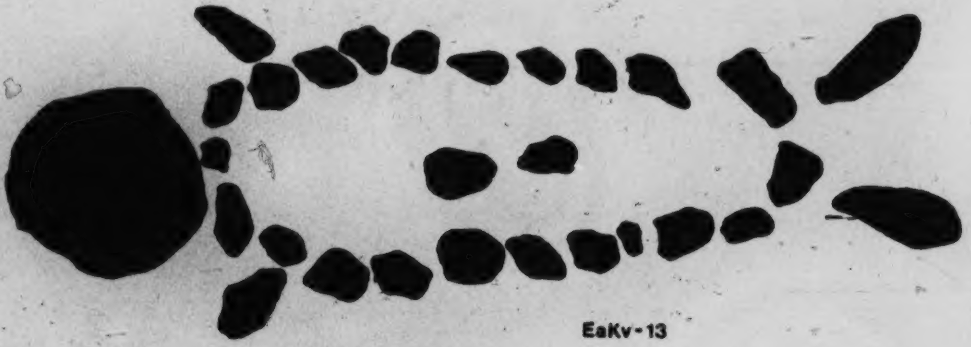


Figure 66
Basket Falls
(adapted after Steinbring 1980:279)

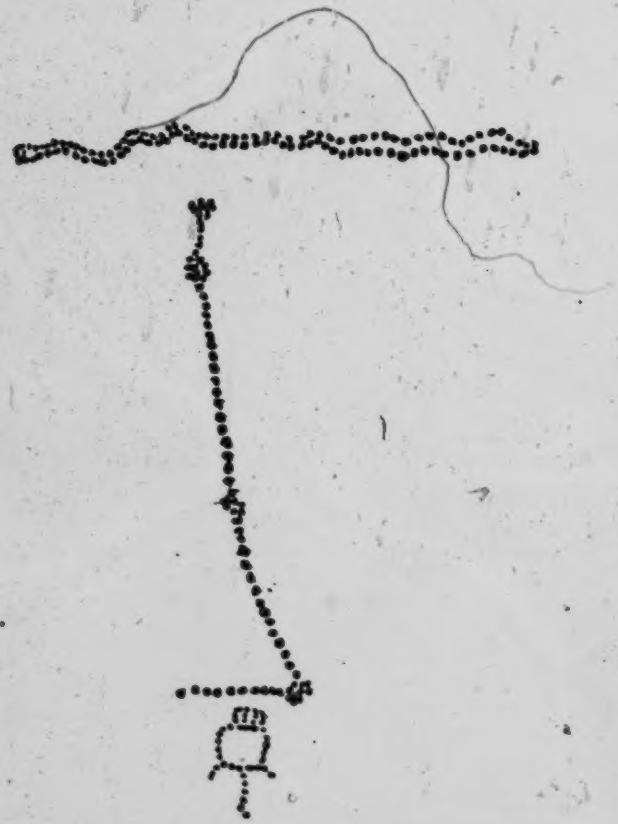


Figure 67 Hughes County Effigies
(adapted after Over 1941:52)

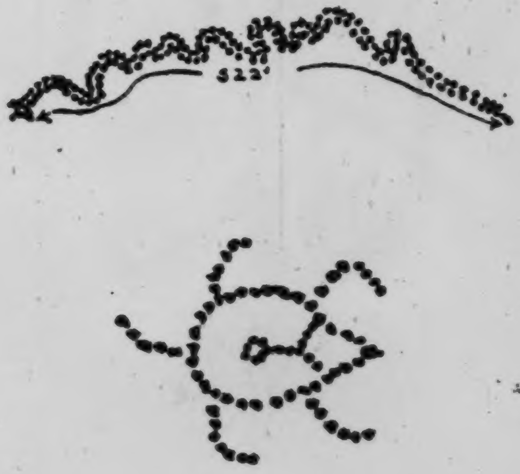


Figure 68 Hughes County Effigies.
(adapted after Over 1941:50,51)

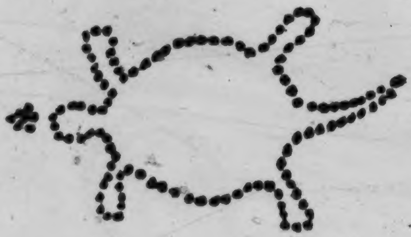


Figure 69

Jerauld County Boulder Outline

(adapted after Over 1941)

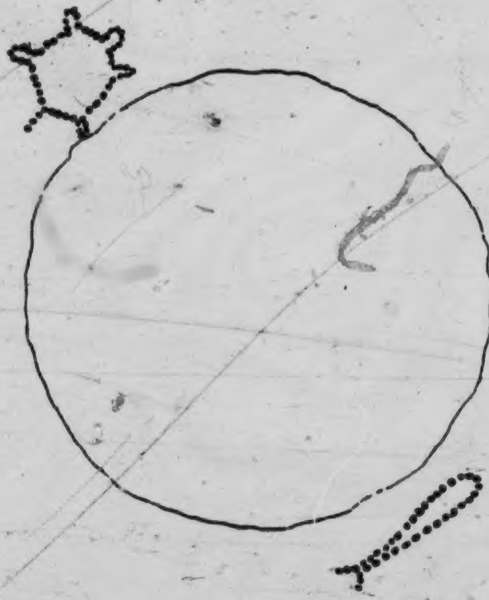


Figure 70

Minnehaha County Effigies (Over 1941: 54)

(adapted after Over 1941:54)

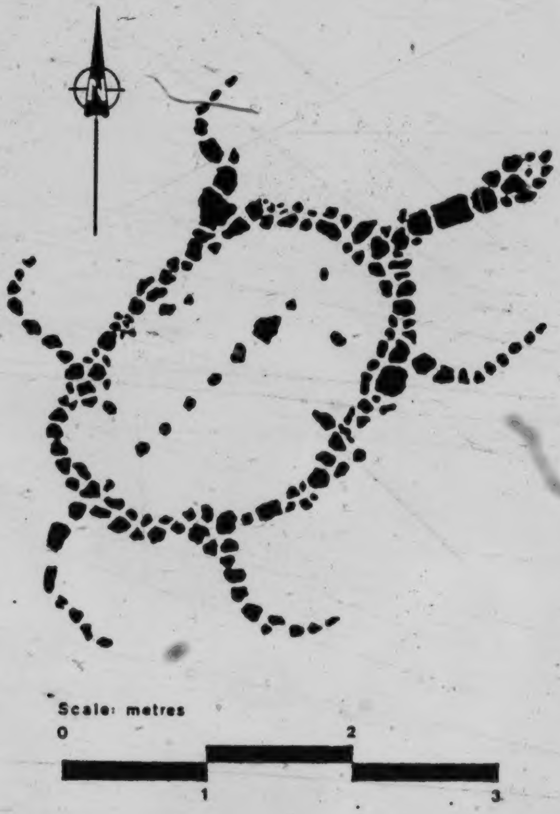

N
Scale: metres
0
1
2
3

Figure 71
NORTH DAKOTA TURTLE
(adapted after Libby 1910:684)

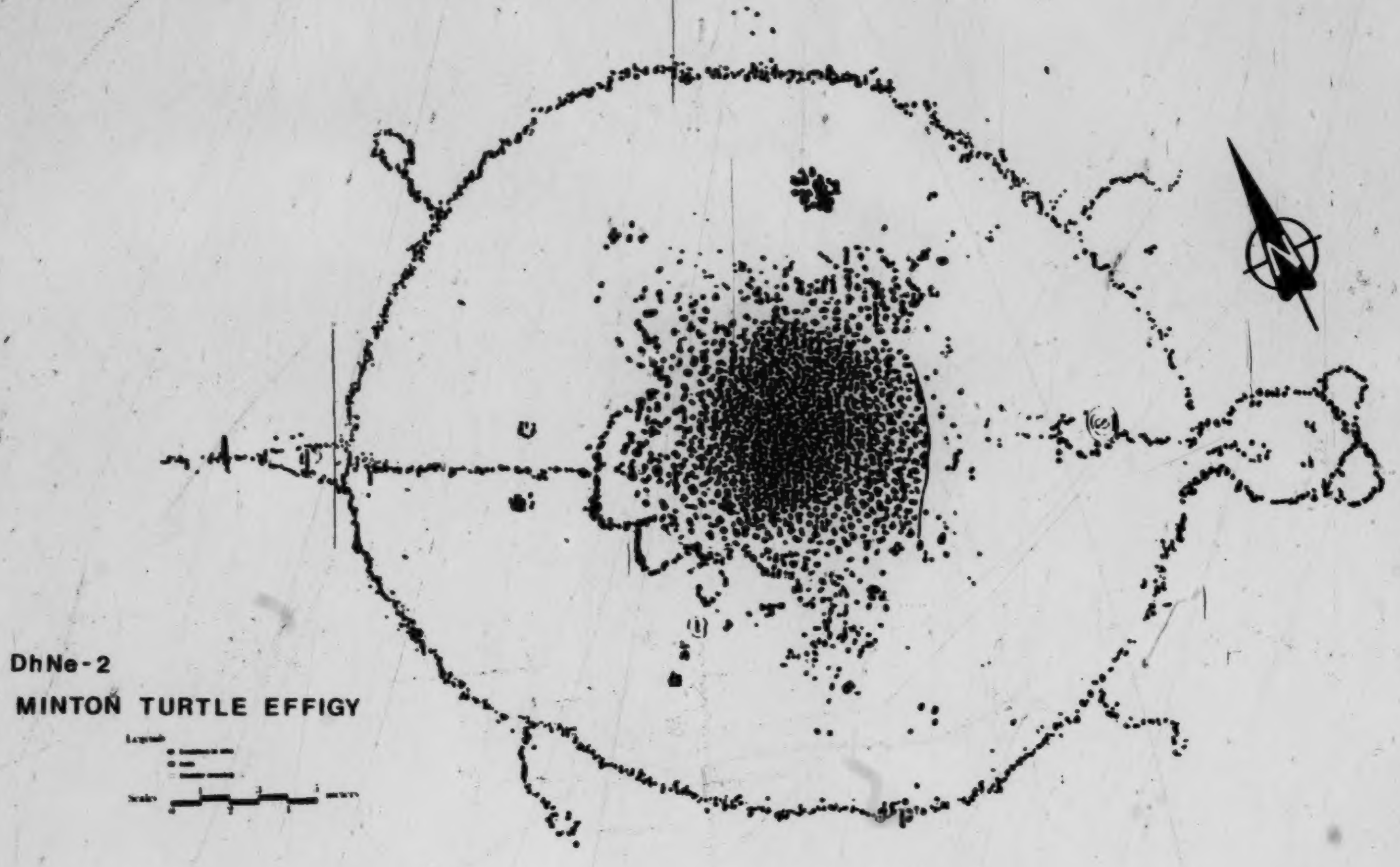

DhNe-2
MINTON TURTLE EFFIGY

Figure 72
(SMNH)

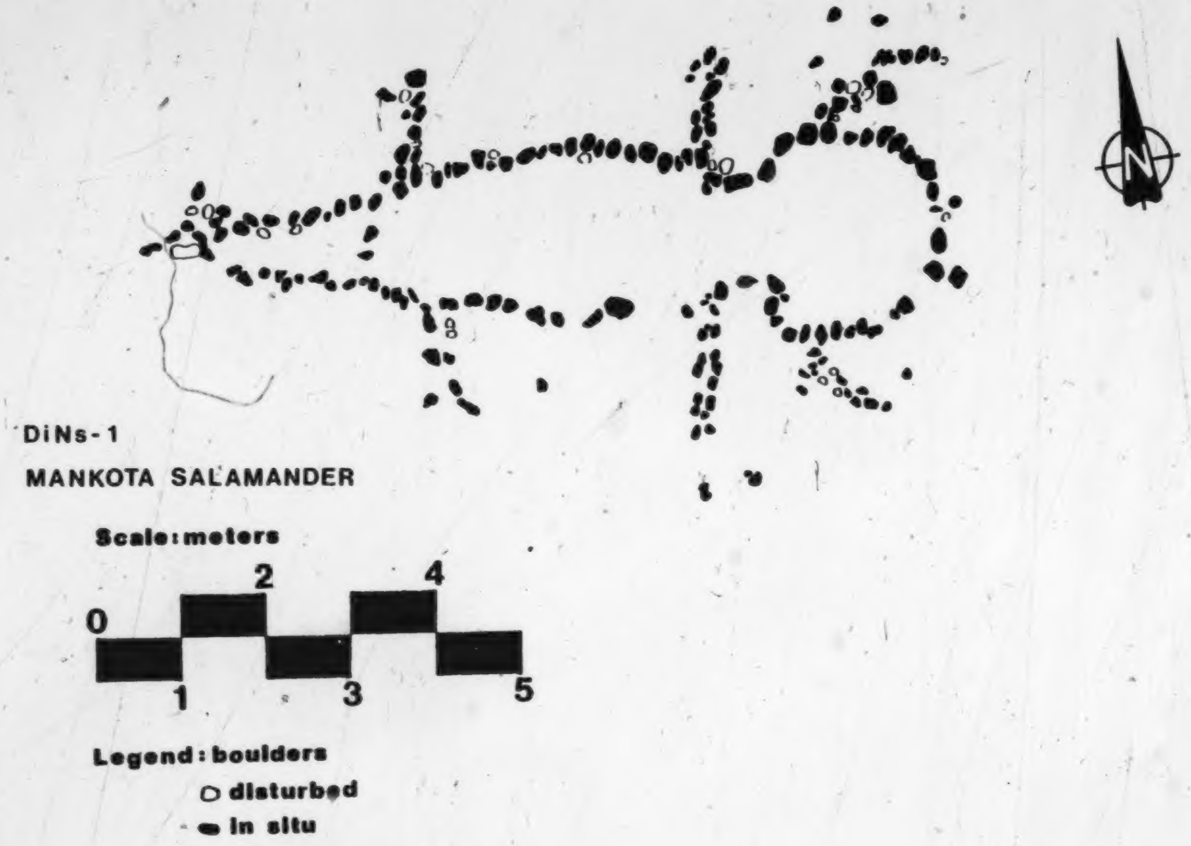

DiNs-1
MANKOTA SALAMANDER
Scale: meters
0
1
2
3
4
5
Legend: boulders
○ disturbed
● in situ
N

Figure 73
(SMNH)

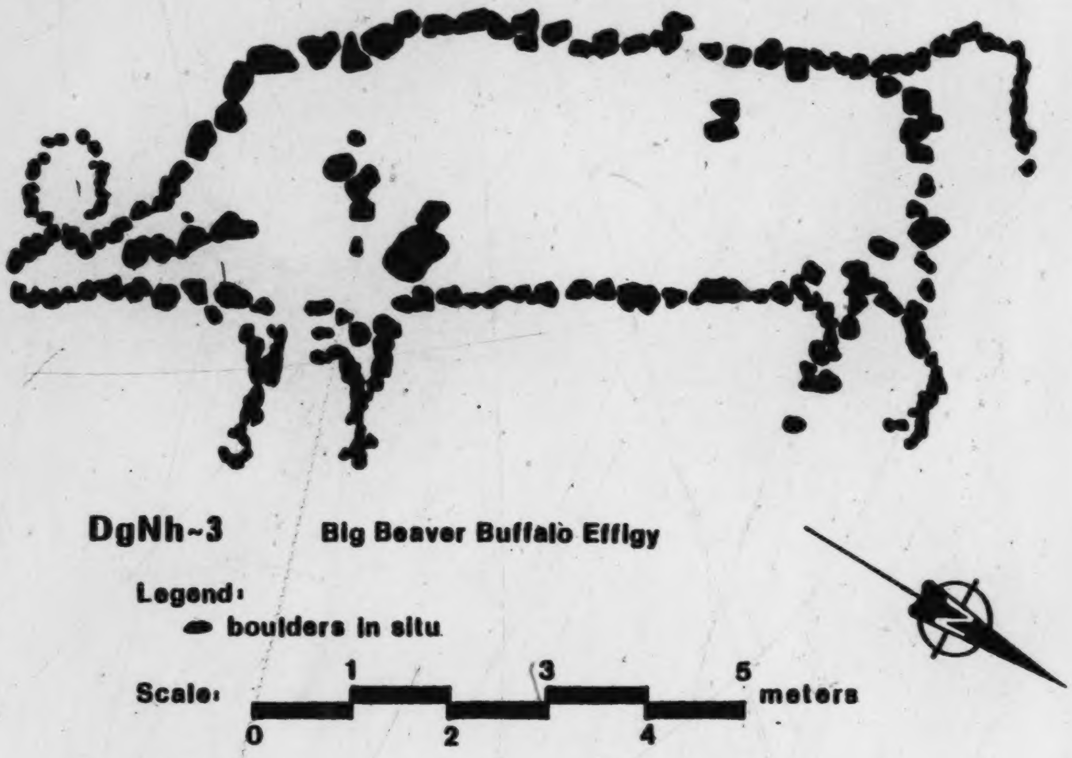

DgNh-3
Big Beaver Buffalo Effigy
Legend:
● boulders in situ
Scale:
0
1
2
3
4
5
meters

Figure 74.
(SMNH)

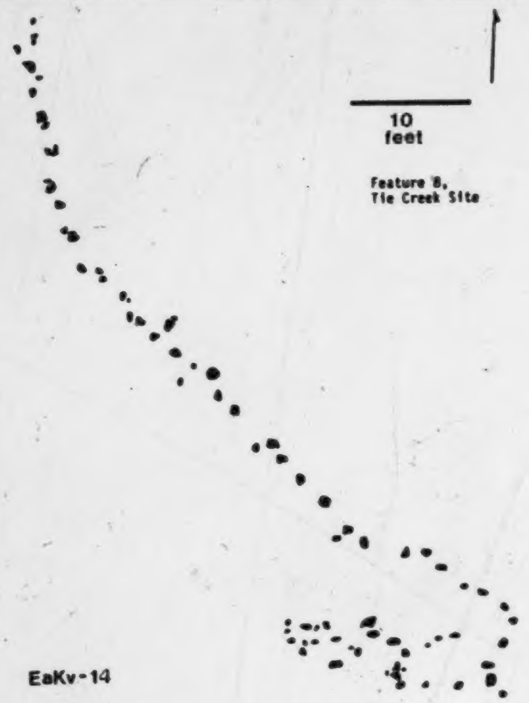

10
feet
Feature B,
Tie Creek Site
EaKv-14

Figure 75
Tie Creek Site
(adapted after
Buchner 1976a:22)

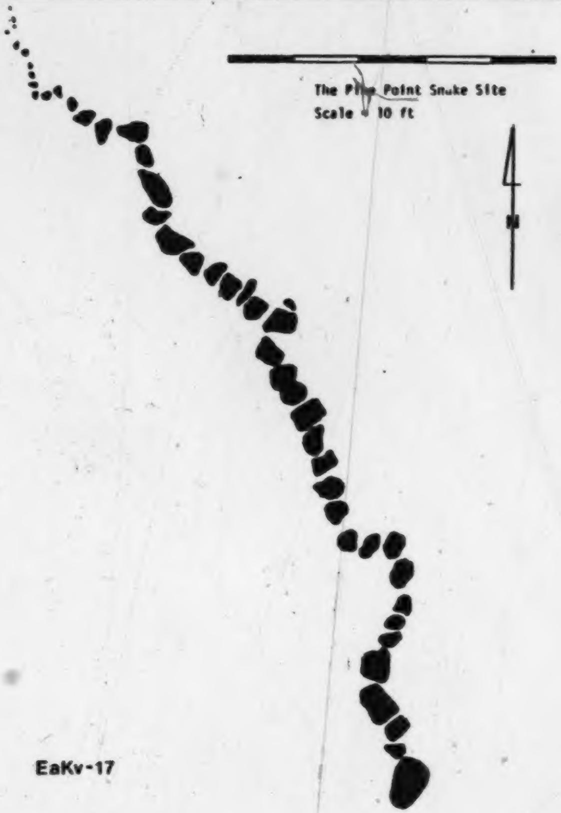

The Pine Point Snake Site
Scale = 10 ft
N
EaKv-17

Figure 76
Pine Point Snake Site
(adapted after
Buchner 1976b:29)

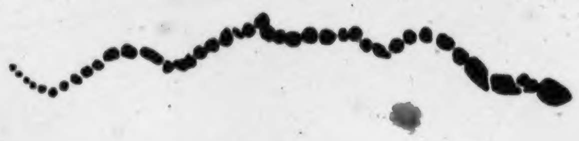


Figure 77
Pine Point Linear
(adapted after Sutton 1965)

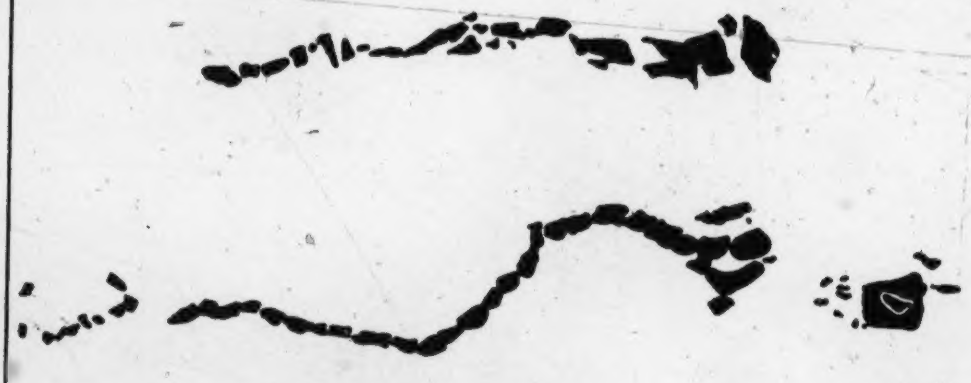


Figure 78
Lac du Bois (adapted after Steinbring 1980)

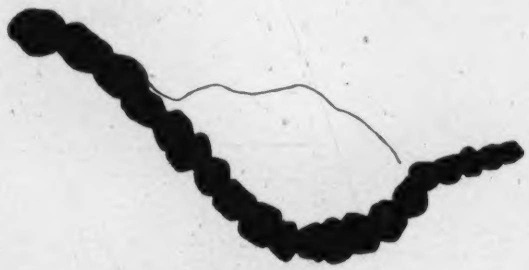


Figure 79
Fred Sieg Farm (adapted after Steinbring 1980:310)

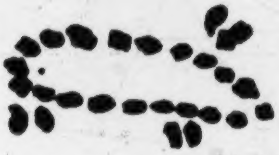


Figure 80
Boulder Outline Custer County
(adapted after Over 1941:48)

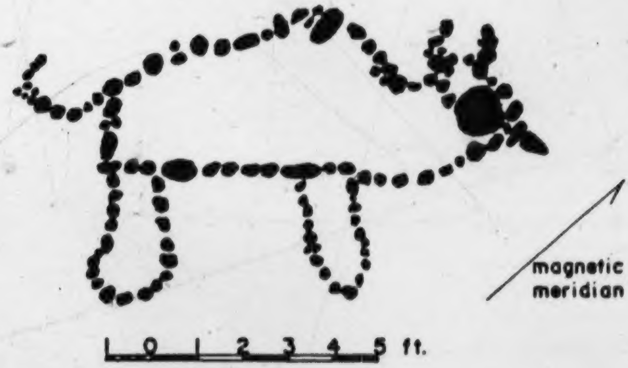

magnetic meridian
0 1 2 3 4 5 ft.

Figure 81
Minnesota Bison Effigy.
(adapted after Steinbring 1970)

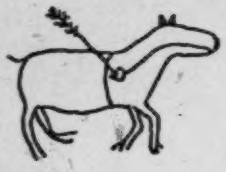
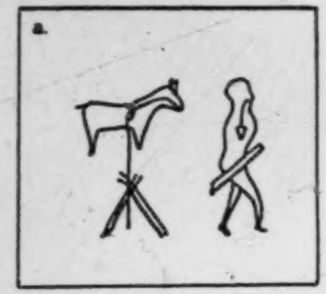


Figure 82

Ojibwa Hunting Song
(James 1830:345,Fig.10)



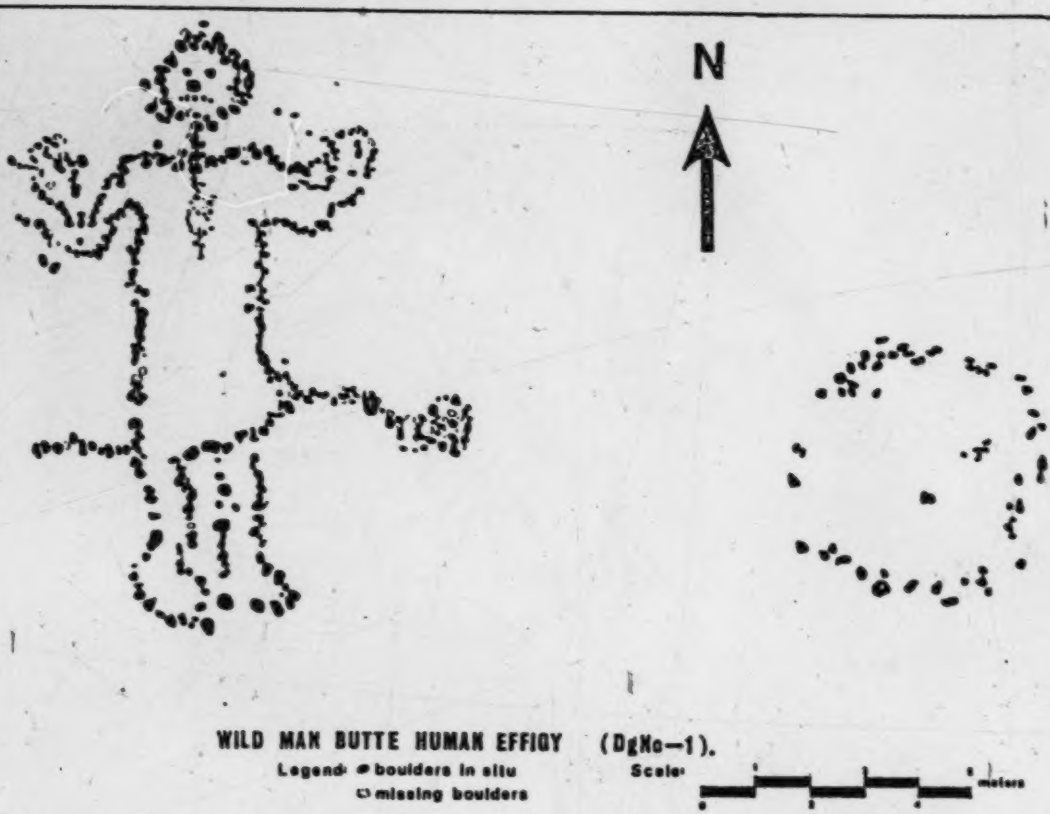

N
WILD MAN BUTTE HUMAN EFFIGY (DgNo—1).
Legend: ● boulders in situ
○ missing boulders
Scale:
0
1
2
3
4
5
meters

Figure 83 (SMNH)
Figure 83a Insert: Ojibwa Hunting Song
(James 1830:372,Fig.10)

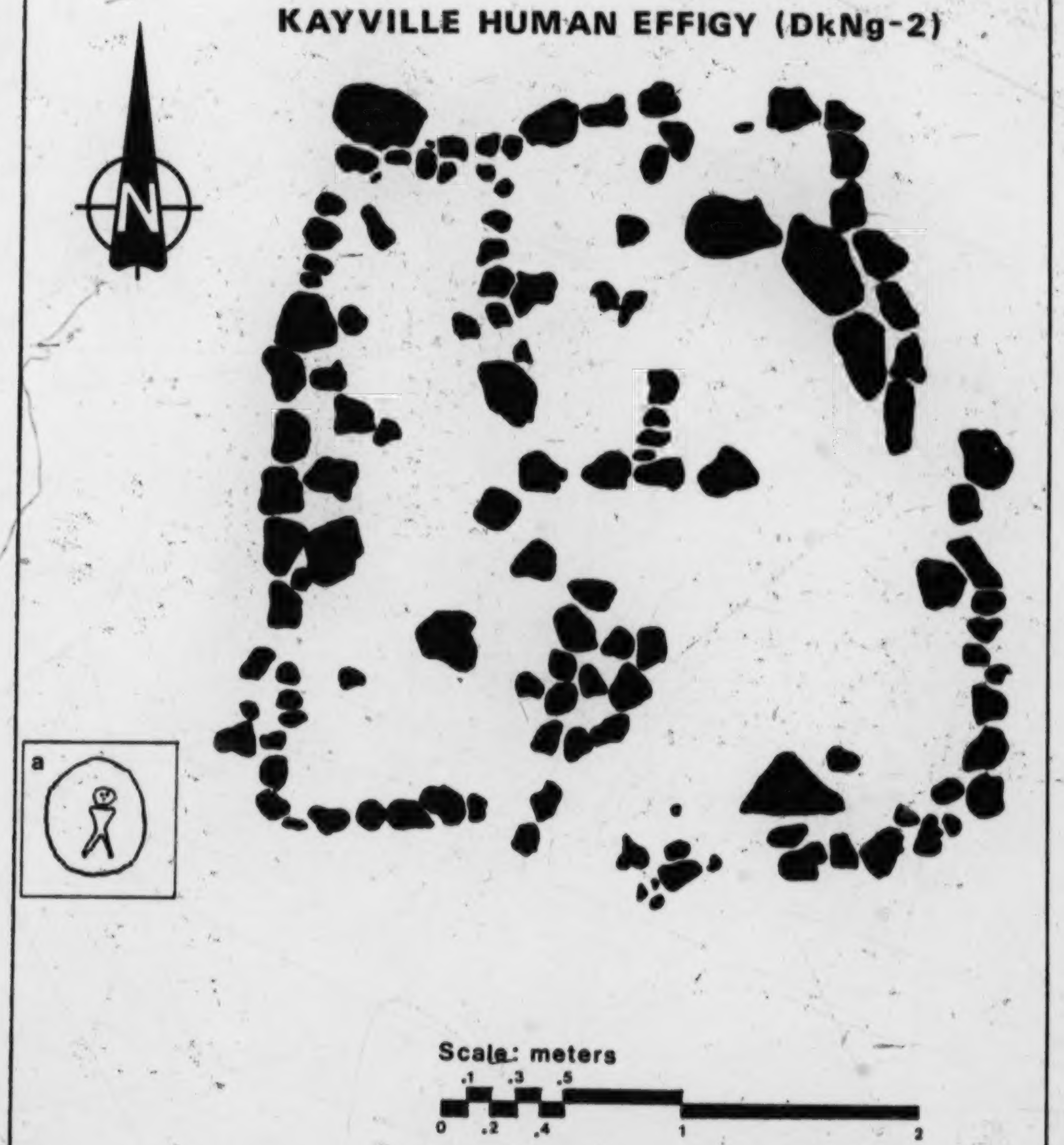

KAYVILLE HUMAN EFFIGY (DkNg-2)
N
a
Scale: meters
.1
.3
.5
0
.2
.4
1
2

Figure 84 (SMNH)
Figure 84a Insert: Ojibwa Love Song (James 1830:372,#13)

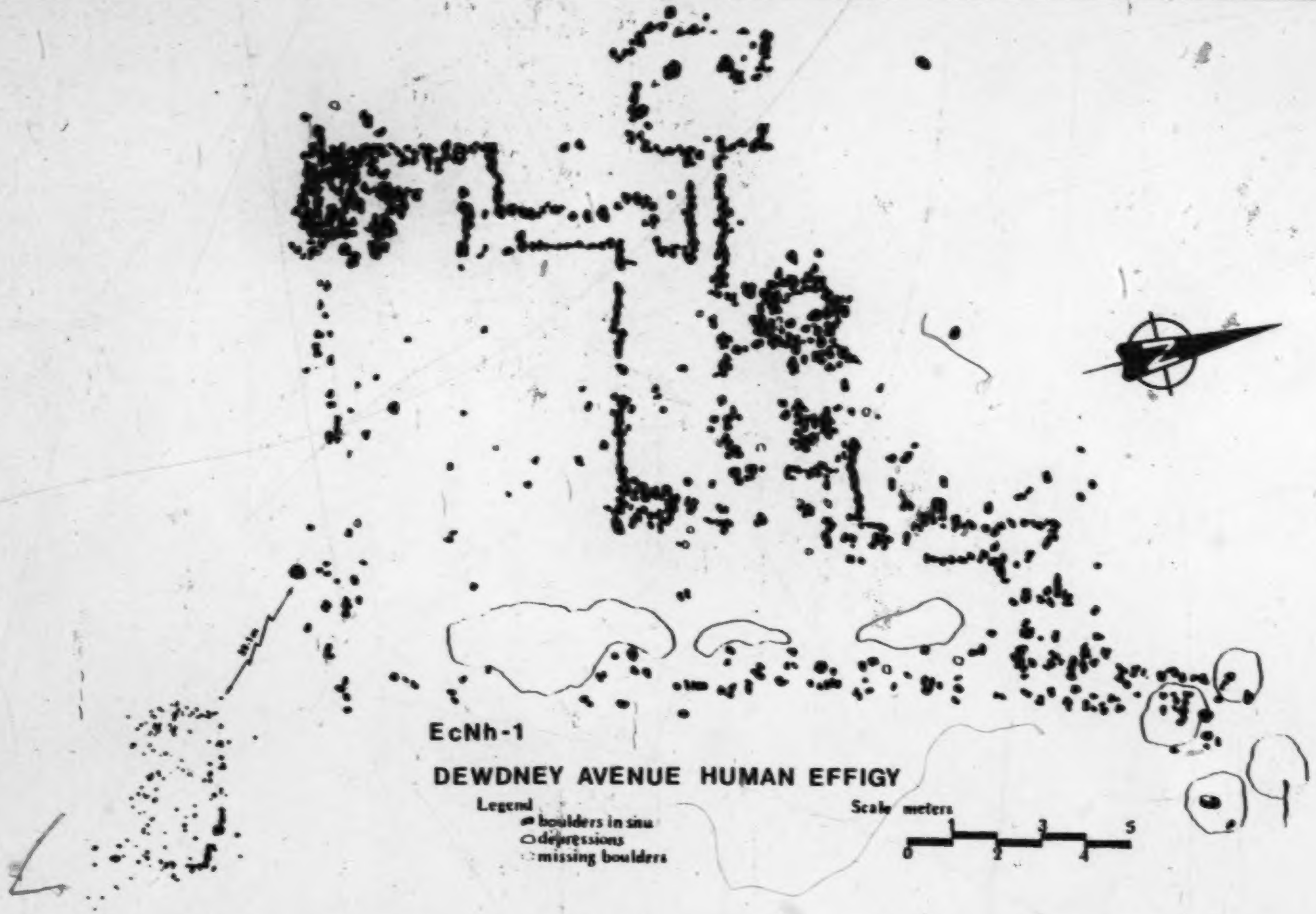

EcNh-1
DEWDNEY AVENUE HUMAN EFFIGY
Legend
● boulders in situ
○ depressions
◌ missing boulders
Scale meters
0
1
2
3
4
5
N

Figure 85
(SMNH)

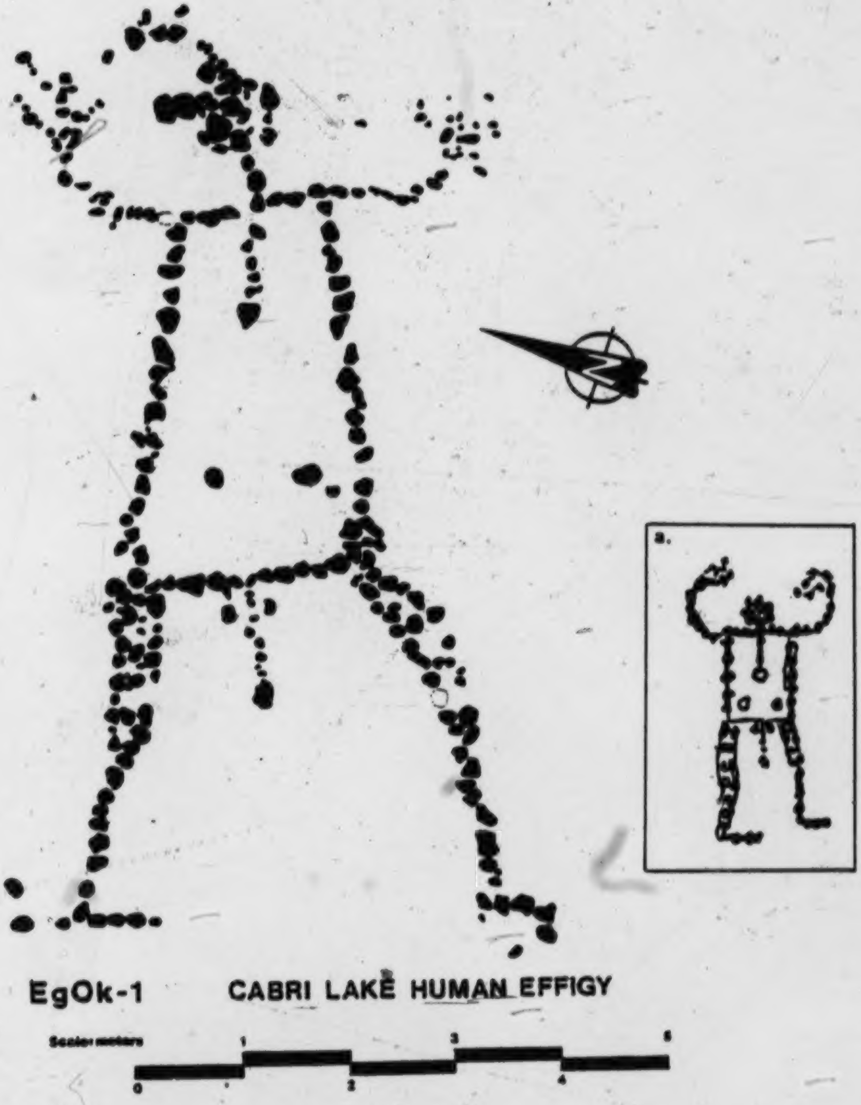

a.
EgOk-1 CABRI LAKE HUMAN EFFIGY
Scale: meters
0
1
2
3
4
5

Figure 36 (SMNH)
Figure 36a Insert: Cabri Lake Human Effigy 1938
(Sewell 1944)

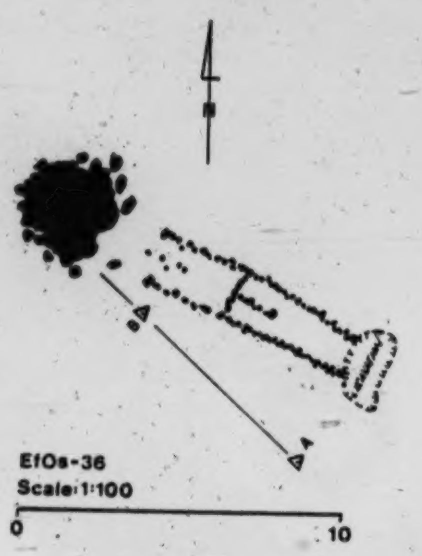

N
B
A
EfOs-36
Scale 1:100
0
10

Figure 87
Ross Medicine Wheel (ASA)

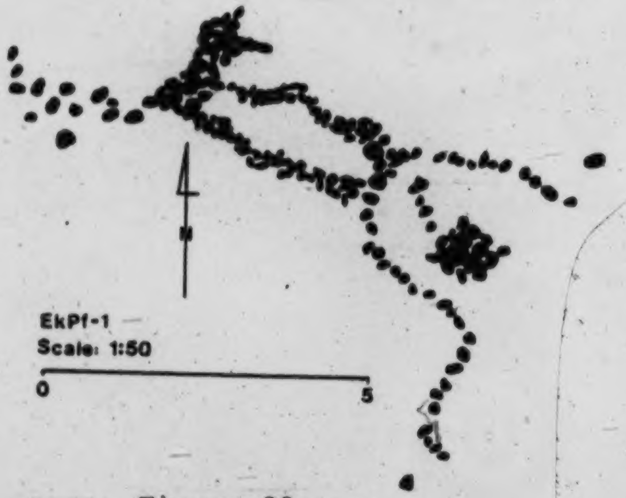

N
EkPf-1
Scale: 1:50
0
5

Figure 88
Rumsey Cairn Medicine Wheel (ASA)

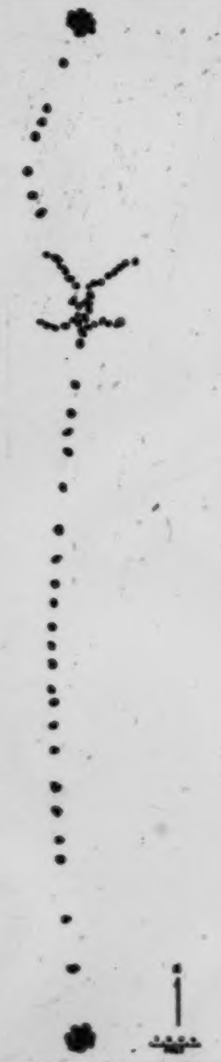


Figure 89
Consort Human Figure
(adapted after Wormington
and Forbis 1965:99)

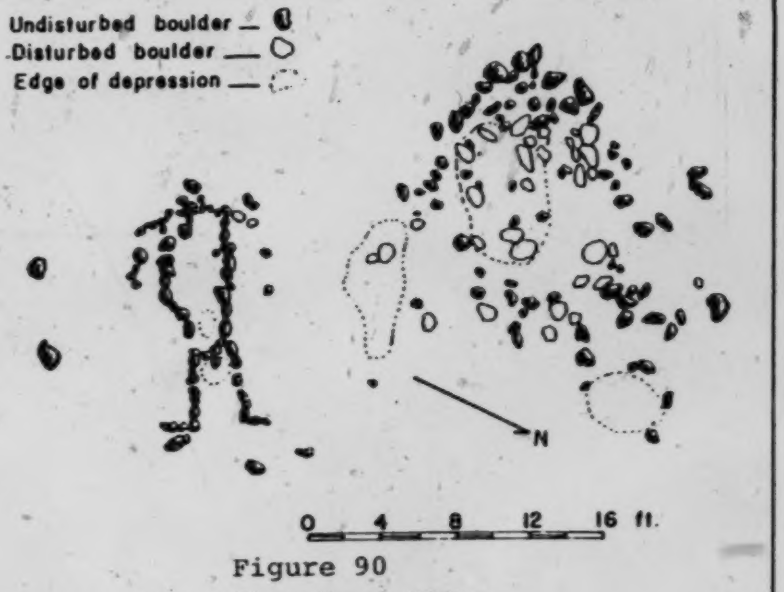

Undisturbed boulder — ●
Disturbed boulder — ○
Edge of depression — ◌
N
0
4
8
12
16 ft.

Figure 90
Cluny Human Effigy
(adapted after Kehoe
and Kehoe 1957:121)

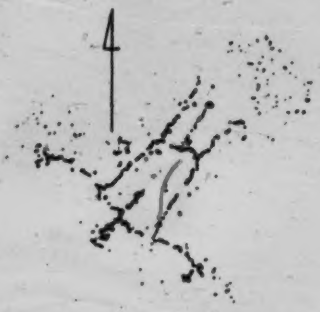


Figure 91
Steveville Boulder Outline
(adapted after Bryan 1968)

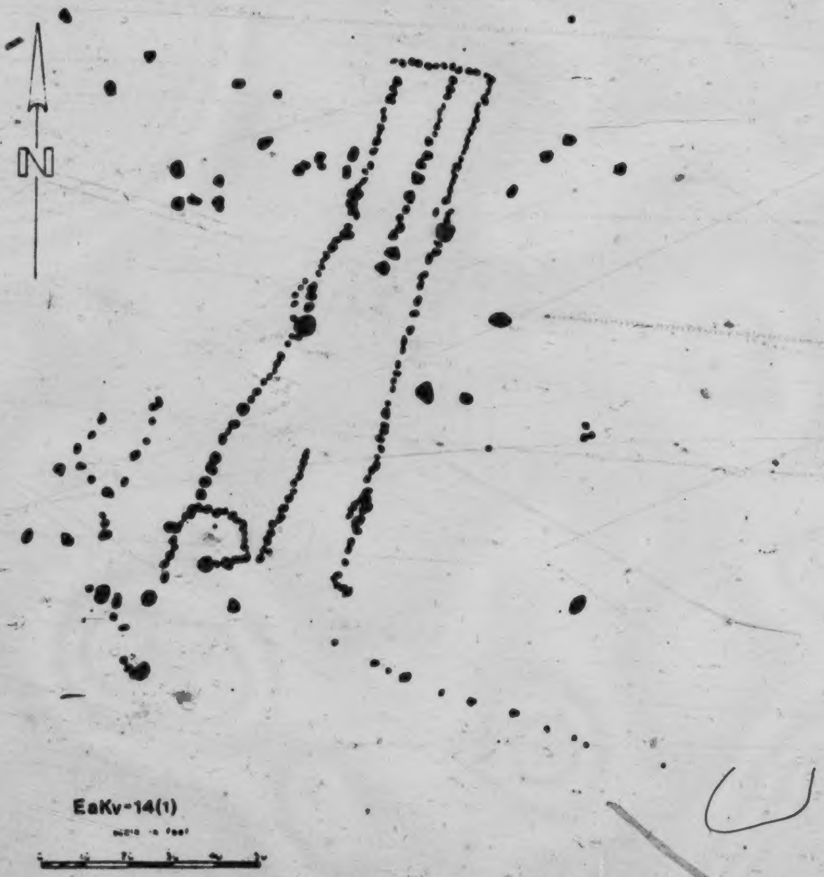


Figure 92
Tie Creek Site (adapted after Steinbring 1970:249)

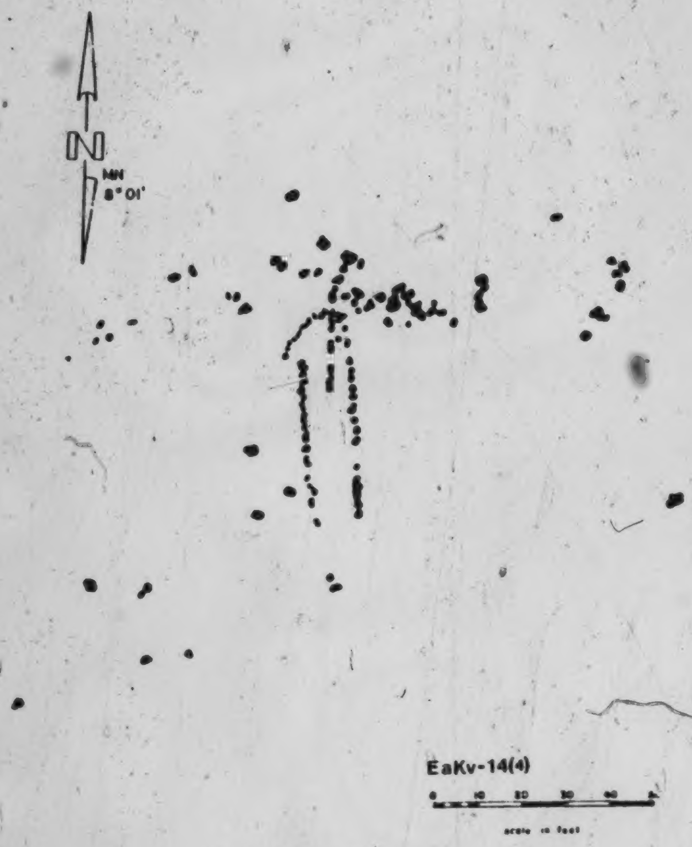

N
MN
8°01'
EaKv-14(4)
0
10
20
30
40
50
scale in feet

Figure 93
Tie Creek Site
(adapted after
Steinbring 1970:245)

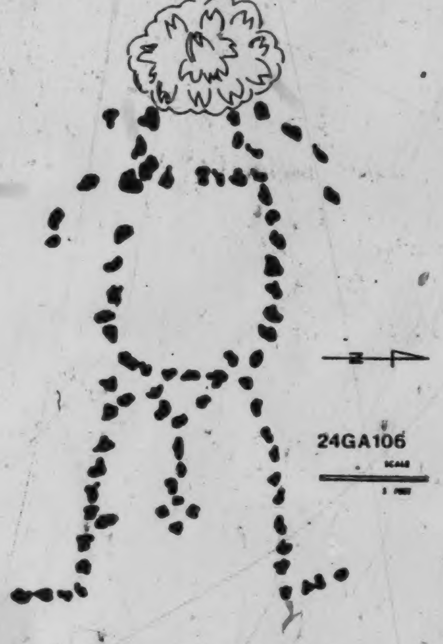

N
24GA106
SCALE

Figure 94
Bozeman Human Effigy
(Malouf 1975;
adapted after Kehoe
and Kehoe 1957:121)

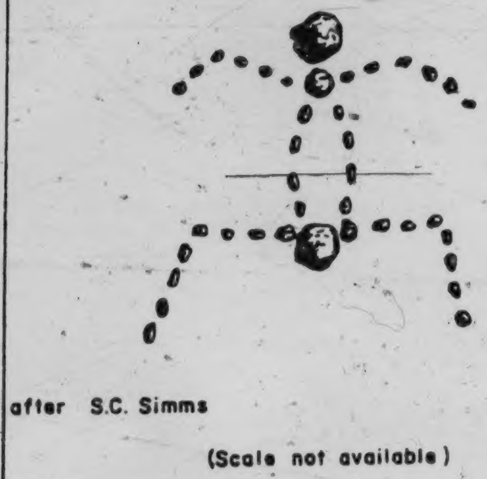

after S.C. Simms
(Scale not available)

Figure 95
Pryor East Site
(adapted after
Simms 1903b Fig. 75)

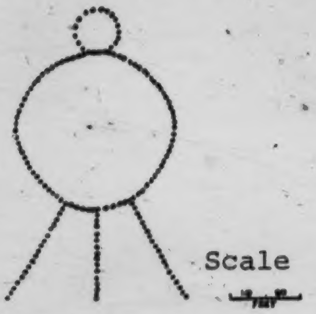


Figure 96
Landslide Butte
(adapted after Kehoe
and Kehoe 1957)

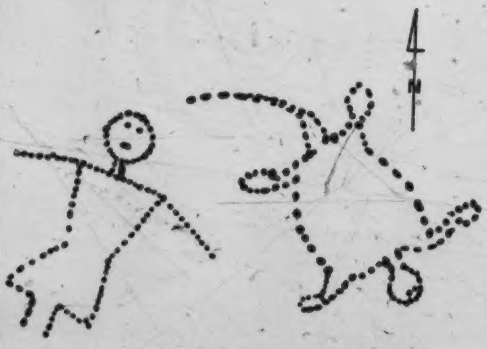


Figure 97
Wessington Springs
(adapted after
Lewis 1891:22)

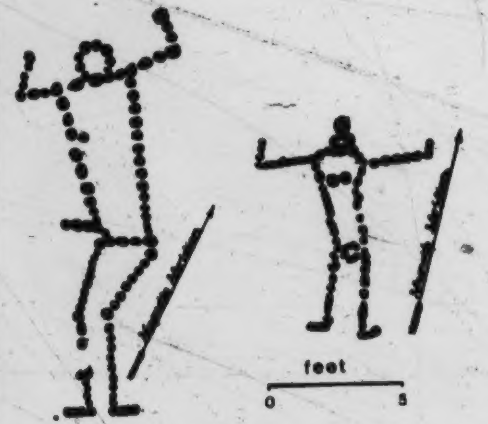


Figure 98

Punished Woman's Hill
(adapted after
Lewis 1889:159)

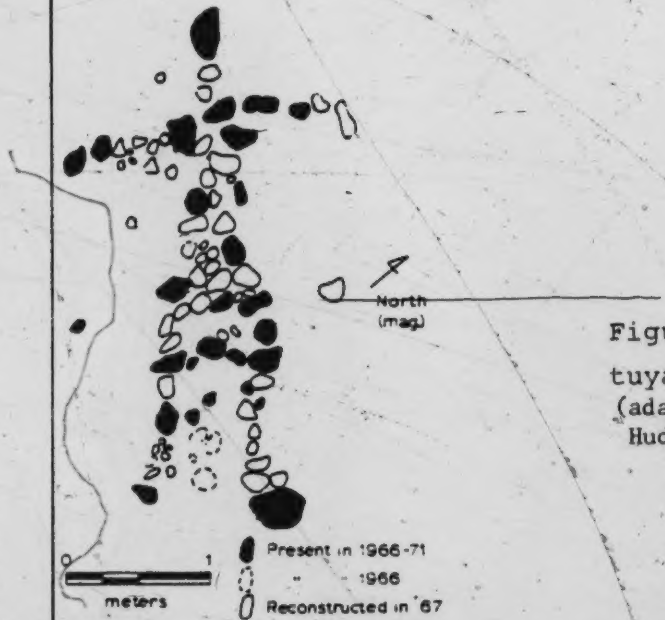

North
(mag)
1
meters
Present in 1966-71
" 1966
Reconstructed in '67

Figure 99

tuyan-witchashta-karpi
(adapted after
Hudak 1972:346)

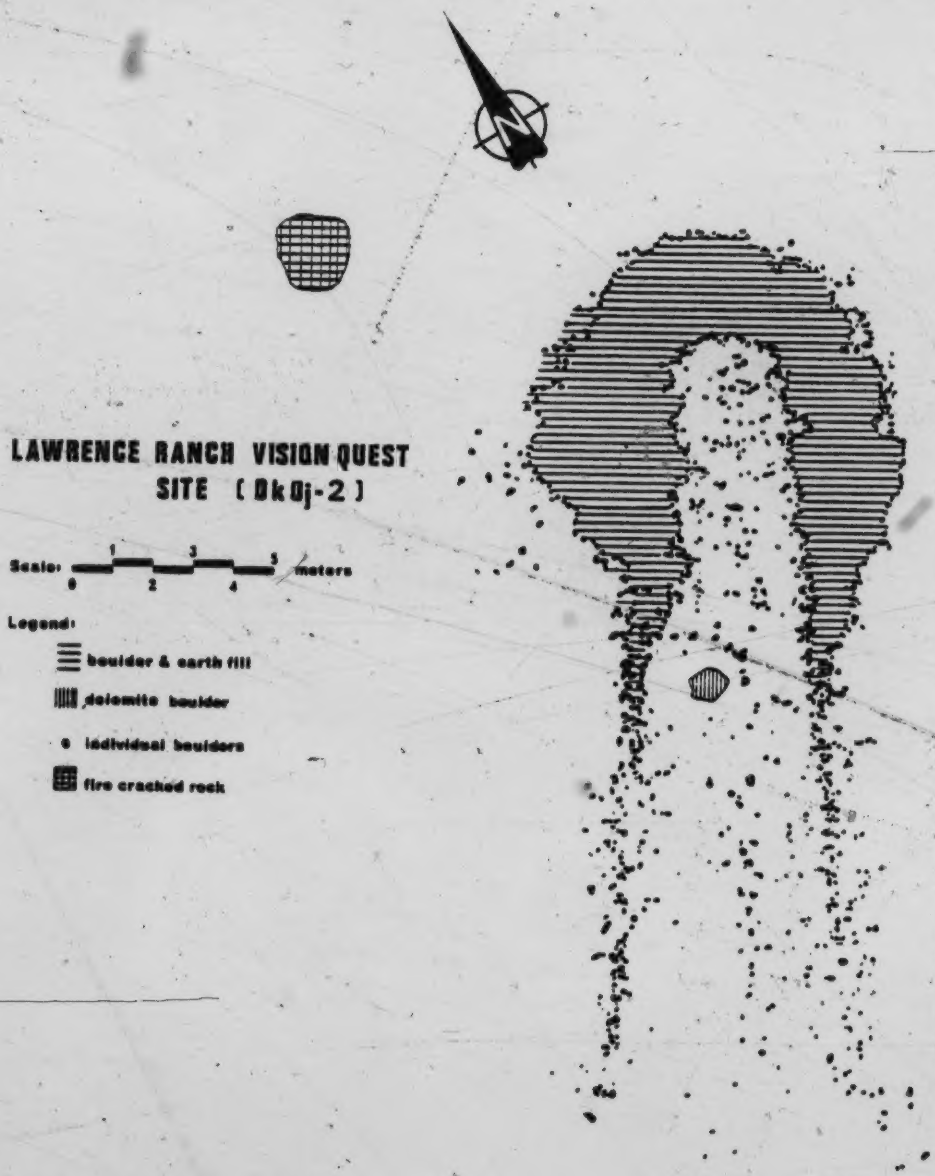

N
LAWRENCE RANCH VISION QUEST SITE (DkOj-2)
Scale: 0 1 2 3 4 5 meters
Legend:
boulder & earth fill
dolomite boulder
individual boulders
fire cracked rock

Figure 100
(SMNH)

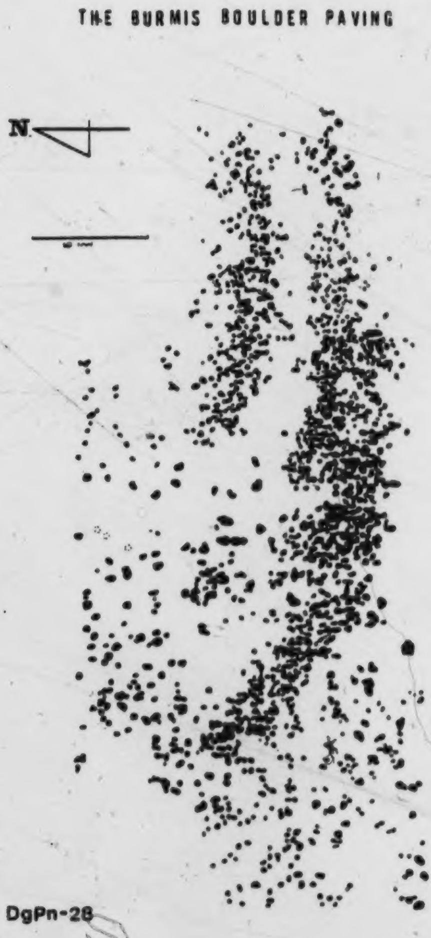

THE BURMIS BOULDER PAVING
N
DgPn-28

Figure 101
(adapted after
Carpenter 1975:38)

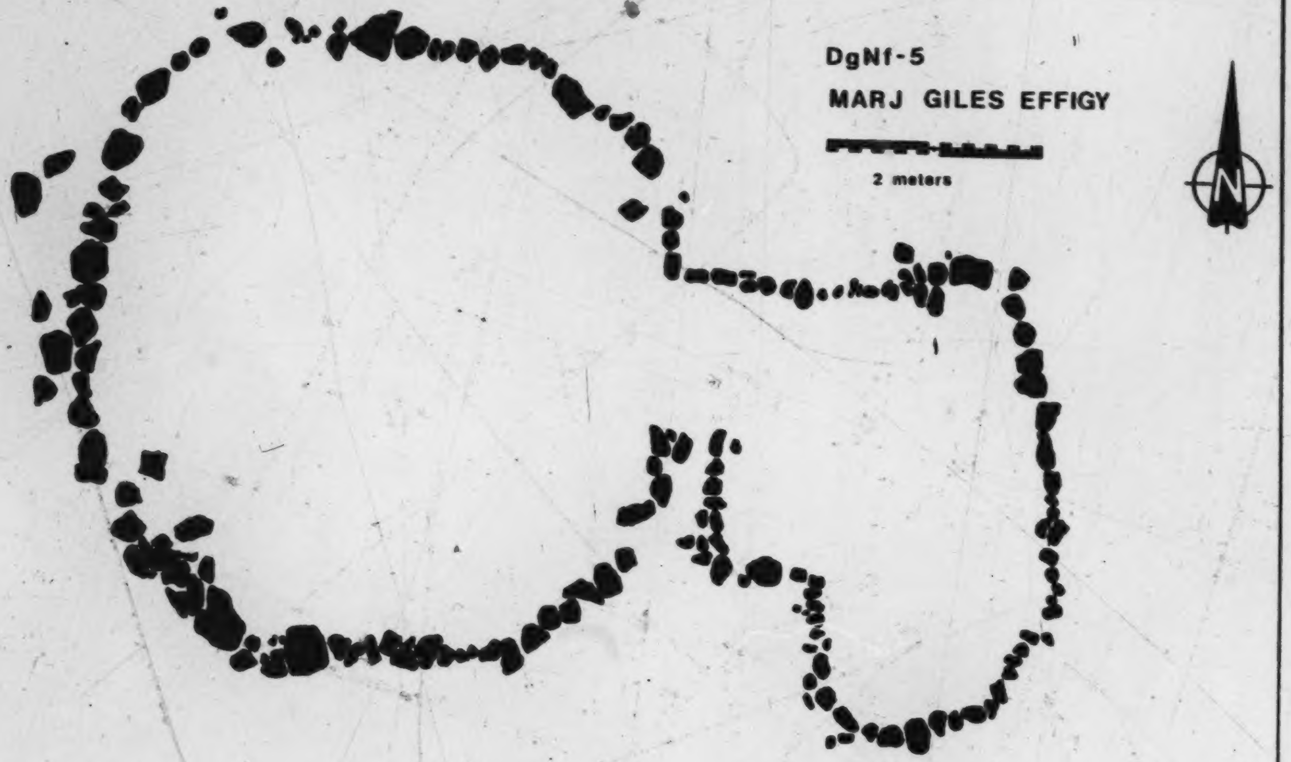

DgNf-5
MARJ GILES EFFIGY
2 meters
N

Figure 102
(SMNH)

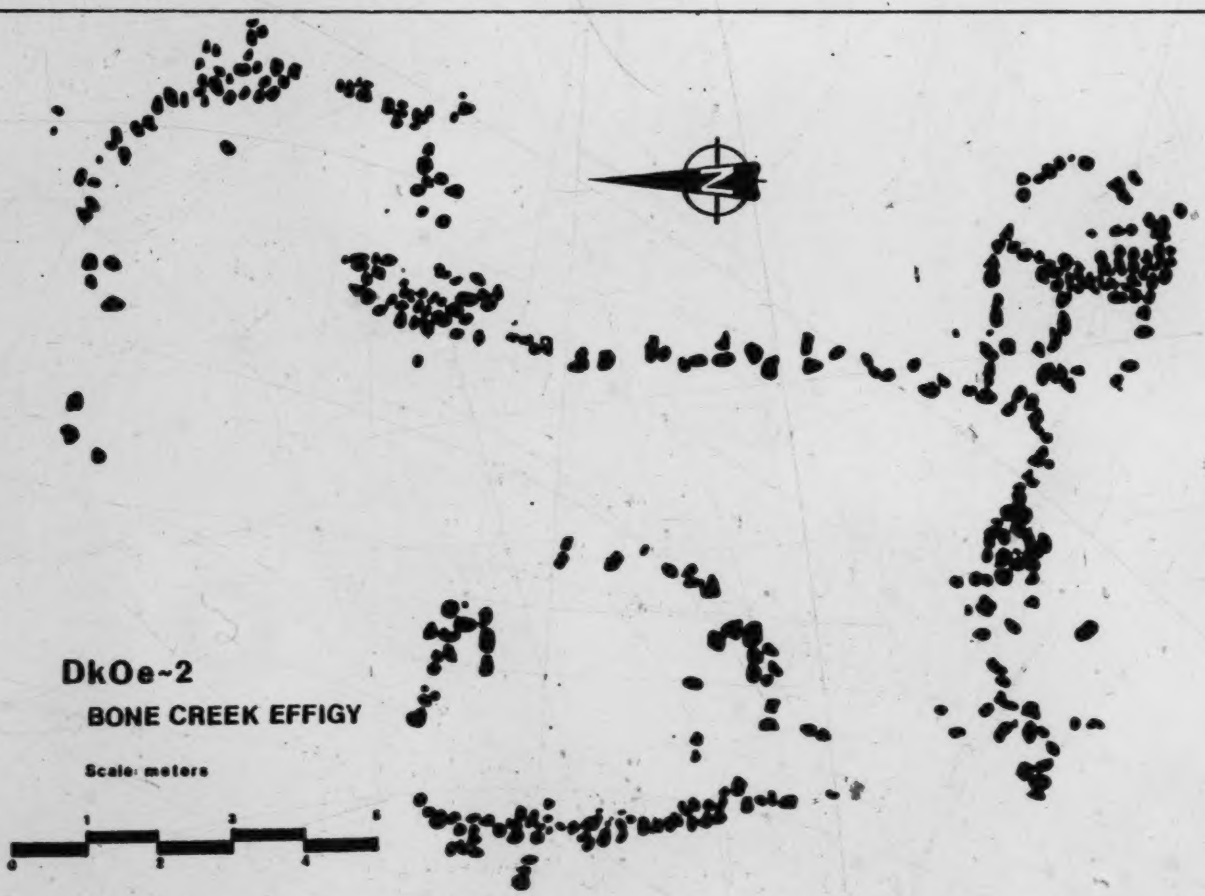

N
DkOe-2
BONE CREEK EFFIGY
Scale: meters
0
1
2
3
4
5

Figure 103
(adapted after Watson 1975:20)

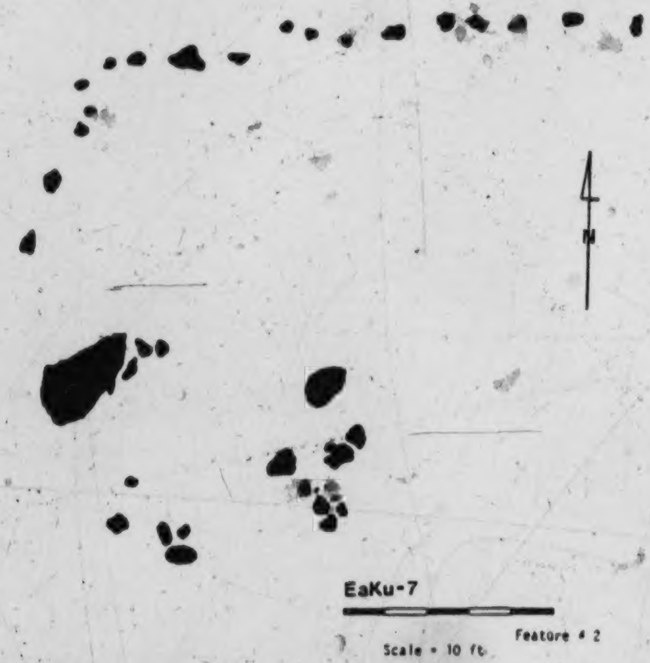

N
EaKu-7
Feature # 2
Scale = 10 ft

Figure 104
Jessica Lake Portage Site
(adapted after Buchner 1976b:33)

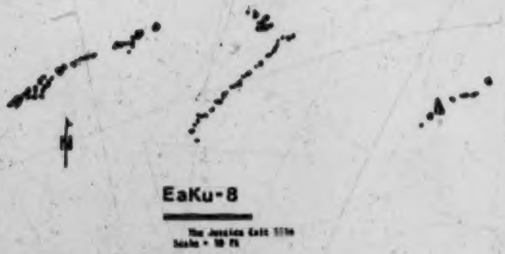

N
EaKu-8
The Jessica Exit Site
Scale = 10 ft

Figure 105
Jessica Exit Site
(adapted after Buchner 1976b:31)

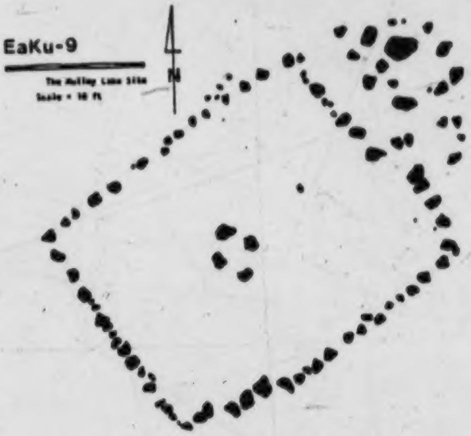

EaKu-9
The Molloy Lake Site
Scale = 10 ft
N

Figure 106
Molloy Lake Site (adapted after Buchner 1976b:34)

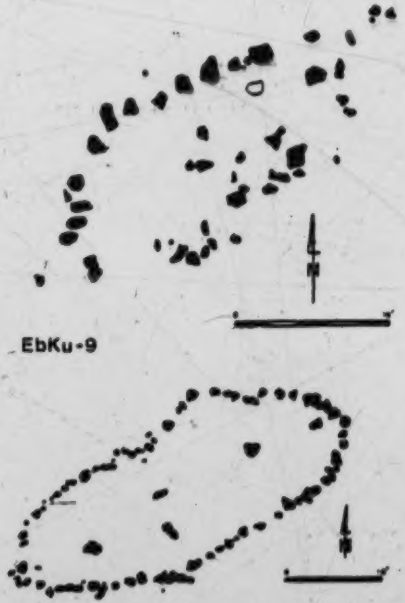

N
EbKu-9
N
The Astwood petroforms, Features #1 (above) and #2 (below).

Figure 107
Astwood Petroforms
(adapted after Buchner and Callaghan 1980:98)

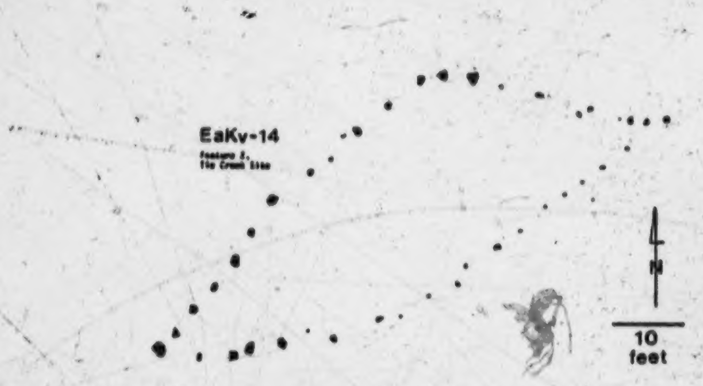

EaKv-14
Feature 2,
Tie Creek Site
N
10
feet

Figure 108
Tie Creek Site
(adapted after Buchner 1976a:16)

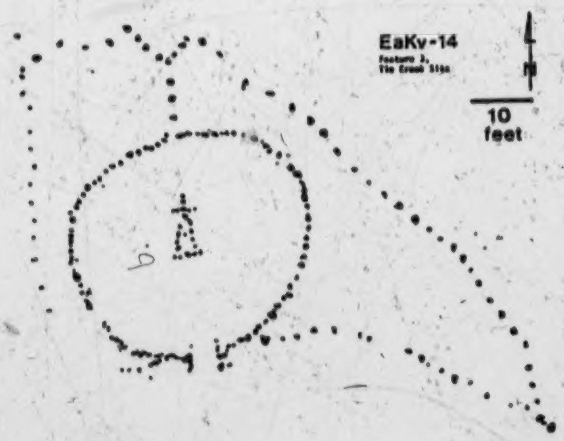

EaKv-14
Feature 3,
Tie Creek Site
N
10
feet

Figure 109
Tie Creek Site
(adapted after Buchner 1976a:17)

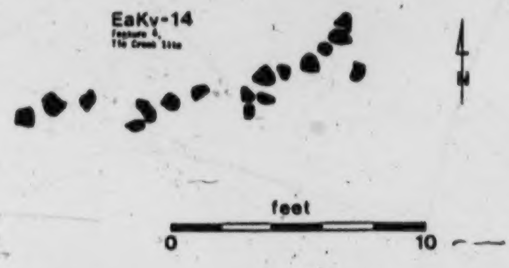

EaKv-14
Feature 6,
Tie Creek Site
N
feet
0
10

Figure 110
Tie Creek Site
(adapted after Buchner 1976a:20)

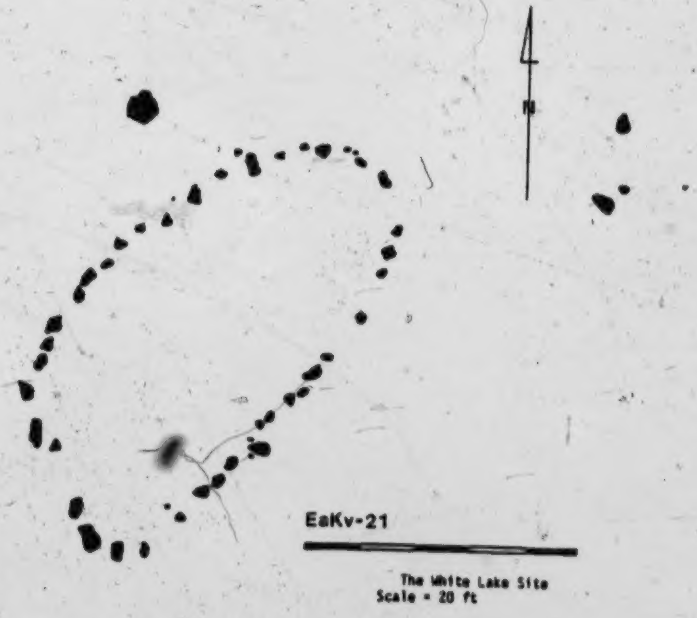

N
EaKv-21
The White Lake Site
Scale = 20 ft

Figure 111
White Lake Site
(adapted after Buchner 1976b:35)

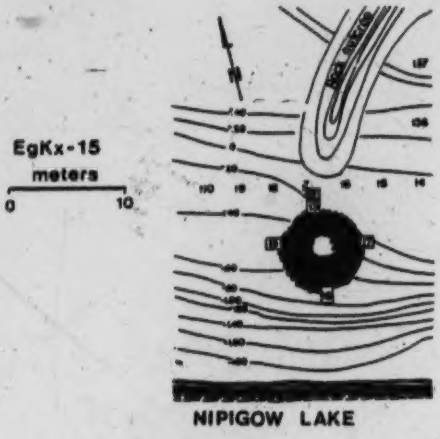

EgKx-15
meters
0
10
NIPIGOW LAKE

Figure 112
The Thunderbird Site
(adapted after Carmichael 1979:8)

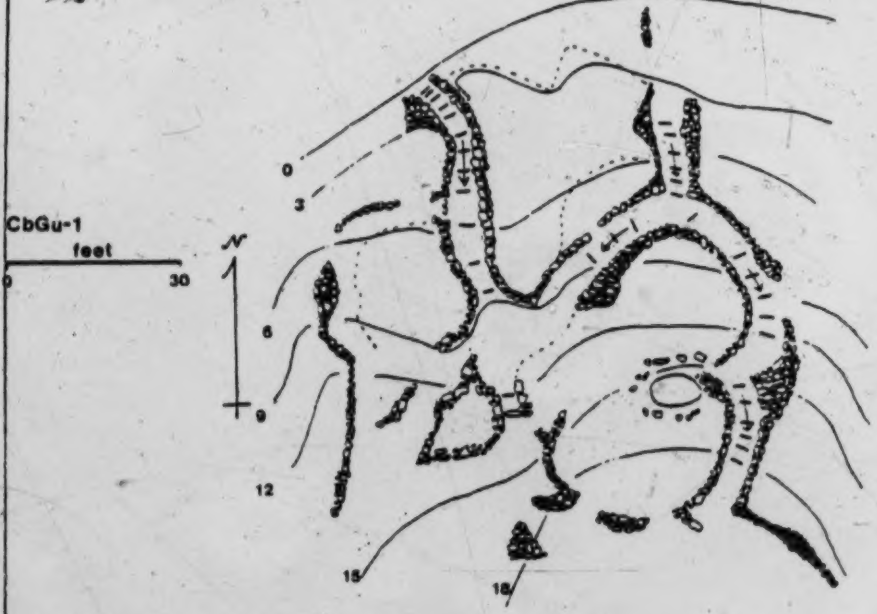
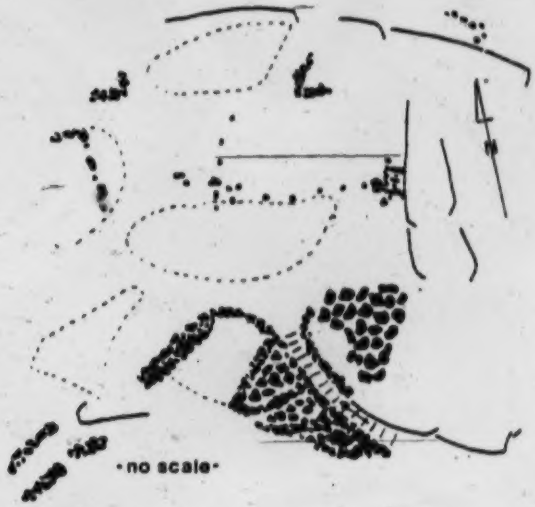
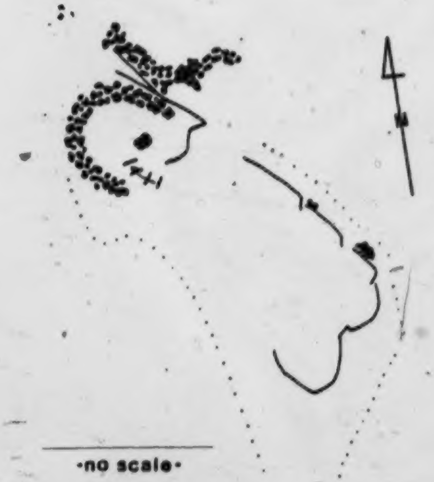

CbGu-1
feet
0
30
N
0
3
6
9
12
15
18

Figure 113
Palframan Site
(adapted after Tyyskä
and Burns 1973:17-23)



CbGu-2

Figure 114
Palframan Sites (adapted after Tyyskä and Burns 1973:23-27)



CcGs-1

Figure 115
Talon Lake Rock Structure
(adapted after Tyyskä and Burns 1973:27)

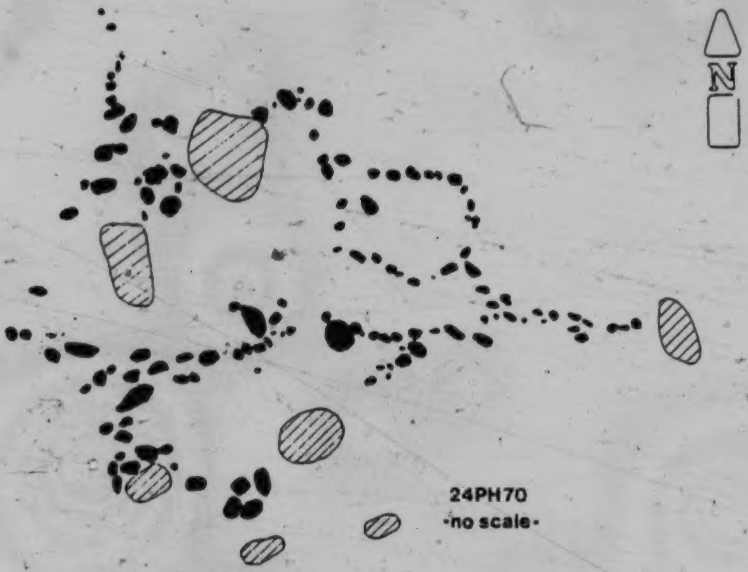

N
24PH70
·no scale·

Figure 116
A.C. Marshall Site
(adapted after Davis 1975:32)

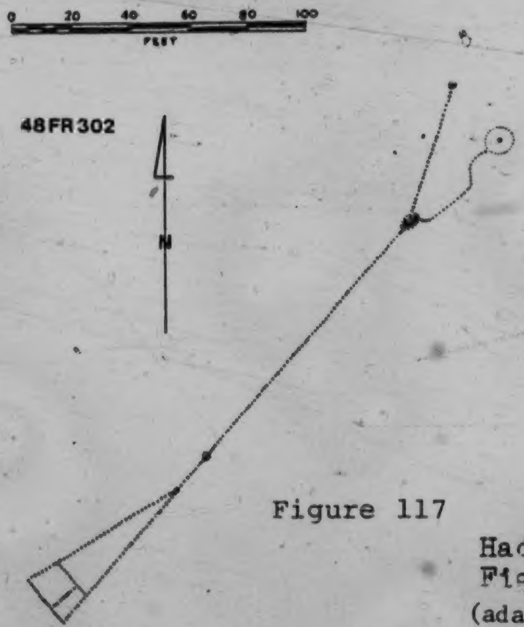

0
20
40
60
80
100
FEET
48FR302
N

Figure 117

Hadsell-Ranch Rock Figure
(adapted after Rea 1966:15-21)

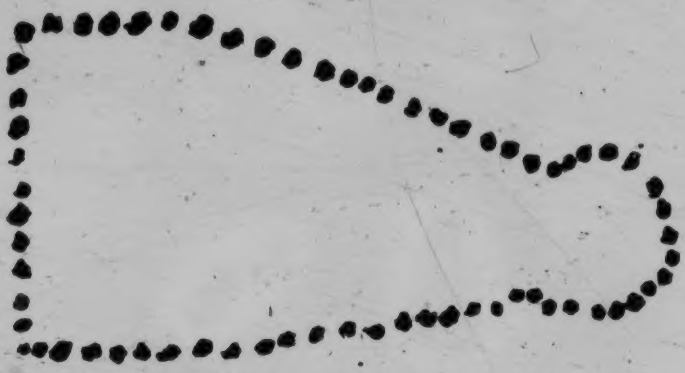


Figure 118
Custer County, Scinger Ranch Figure
(adapted after Over 1941:47)

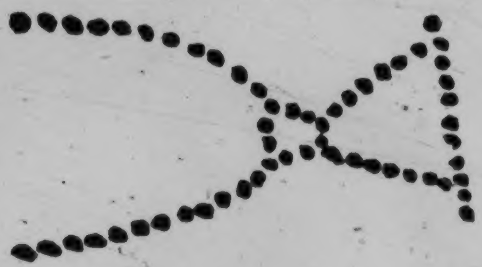


Figure 119
Custer County, Boulder Outline
(adapted after Over 1941:48)

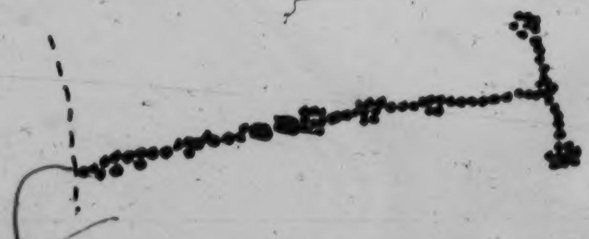


Figure 120
Custer County, Sampson Ranch
(adapted after Over 1941:49)

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APPENDIX I

LICHENOMETRIC THALLUS MEASUREMENTS

Table Organization

All tables in this section are organized identically to facilitate comparison with the mean ($\bar{x}$) and Standard Deviation (S.D.). The Borden numbers reference each table and accompanying graph to Table 1. The parenthesised G refers to a granite substratum, while Q refers to a quartzite substratum. Diameter measurements for Borden sites are to the left, historic sites to the right in the order of:

North-South Thallus Diameter	East-West Thallus Diameter	Diameter Differences	Average Thallus Diameter

The Standard Deviations were computed from the formula:

$$S \doteq \sqrt{\frac{\Sigma_{i=1}^{n} X^2 - \left[\left(\Sigma X_i\right)^2 / n\right]}{n-1}}$$ (Thomas 1976:79).

The lower graph's vertical and horizontal distances represent one inch equal to ten millimetres. In these graphs, the horizontal 'x' line represents the east-west diameter measurements, while vertical 'y' line represents the north-south diameter measurements. The individual dots represent the observed lichen diameters from the boulder monument site, while a dot inside a square illustrates the Dimelaena oreina comparative diameters observed. For a single comparison at E10d-2, Rhizoplaca menophthalma was also used for comparative purposes, those comparative diameters are symbolized by a dot within a circle. In all cases historic D. oreina diameters were only compared to prehistoric D. oreina diameters. At the historic site listed, R. menophthalama was compared only against R. menophthalama on the boulder monument.

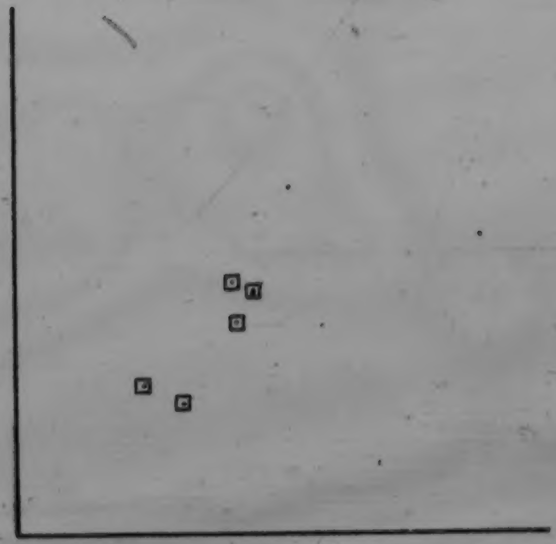
DgMn-3#1
(Q)

19.7	15.5	4.2	17.6
17.0	26.1	9.1	21.55

Rockpile, ca. 1926
(Q)

8.4	7.1	1.3	7.75
7.9	9.1	1.7	8.25
12.0	12.8	.8	12.4
14.1	12.3	1.8	13.2
13.7	13.2	.5	13.45

$\bar{x}$ = 11.01
S.D. = 2.09



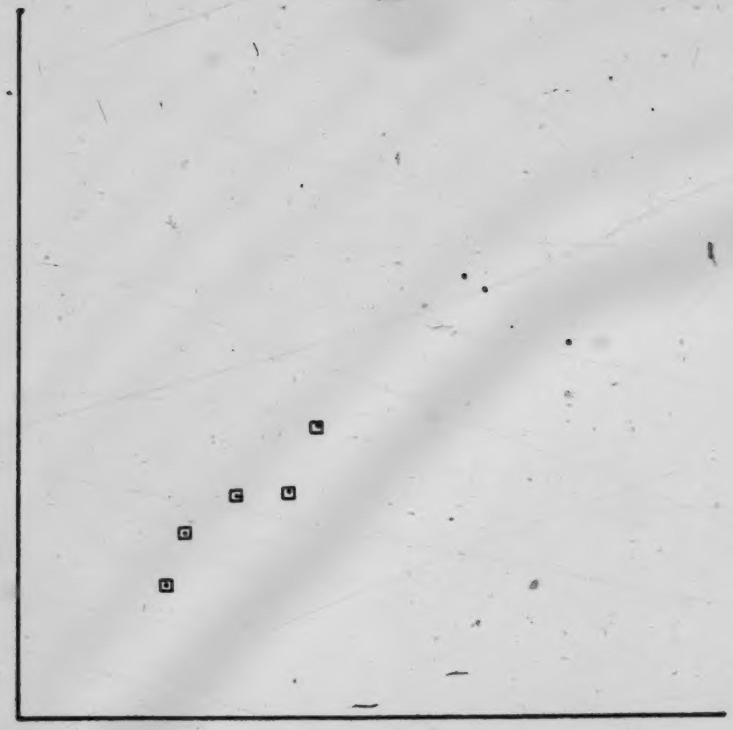
DgMn-3#1
(G)

25.0	25.4	.4	25.2
24.1	26.7	2.6	25.4
21.1	31.2	10.1	26.15

Rockpile, ca. 1926
(G)

7.3	8.1	.8	7.7
10.1	9.9	.2	10.0
12.4	12.6	.2	12.5
12.9	15.4	1.5	14.15
16.5	17.0	.5	16.75

$\bar{x} = 12.22$
S.D. = 3.5



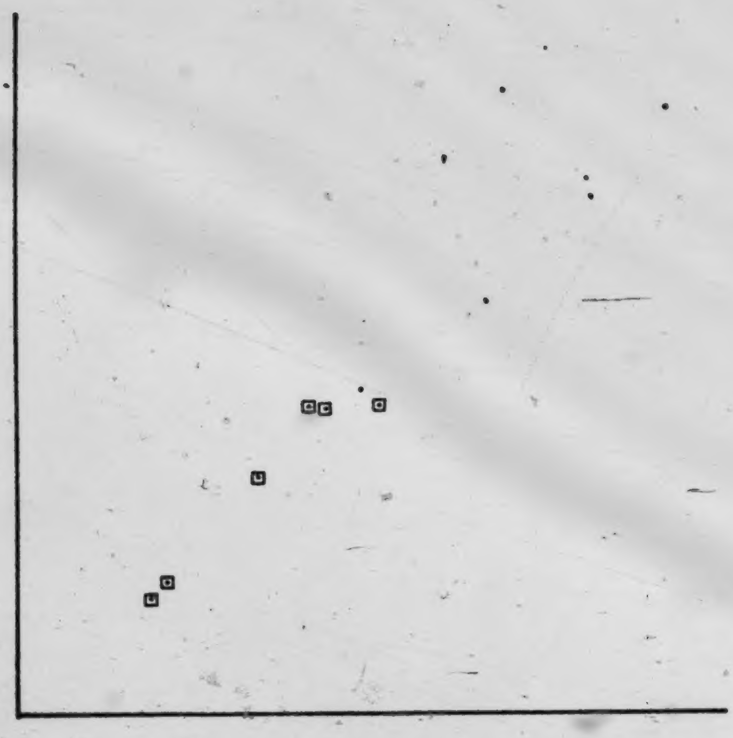
DiMv-2
(G)

18.6	19.1	.5	18.85
21.4	25.6	4.2	23.5
23.8	26.2	2.4	25.0
31.7	24.0	7.7	27.85
32.3	29.1	3.2	30.7
30.1	32.0	.9	31.05
35.3	27.1	8.2	31.2
34.9	36.7	1.8	35.8

$\bar{x} = 27.99$
S.D. = 5.35

Cemetery, (various dates)
(G)

1906:	17.2	17.1	.1	17.15
1911:	13.2	13.4	.2	13.3
1917:	7.2	8.3	1.1	7.75
1917:	20.2	17.9	2.3	19.05
1924:	17.8	16.6	1.2	17.2
1932:	6.9	7.4	.5	7.15



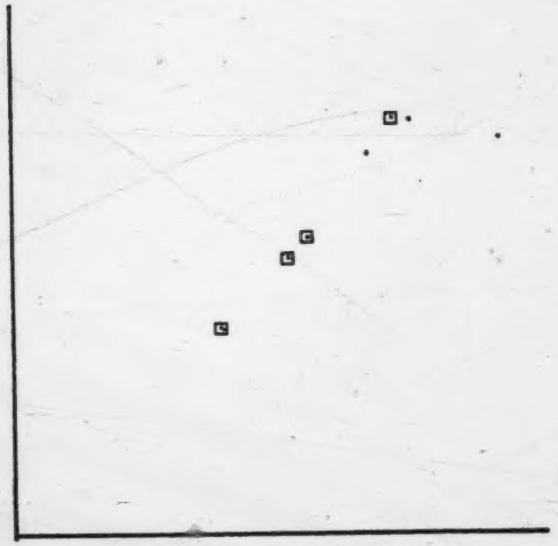
DjMr-1
(Q)

21.7	20.0	1.7	20.85
23.1	27.4	1.3	23.75
22.9	27.6	4.7	25.25

Rockpile, ca. 1910
(Q)

11.6	11.7	.1	11.65
15.8	15.4	.4	15.6
16.1	16.4	.3	16.25
23.9	21.2	2.7	22.55

$\bar{x}$ = 16.51
S.D. = 4.51



DkMq-2
(G)

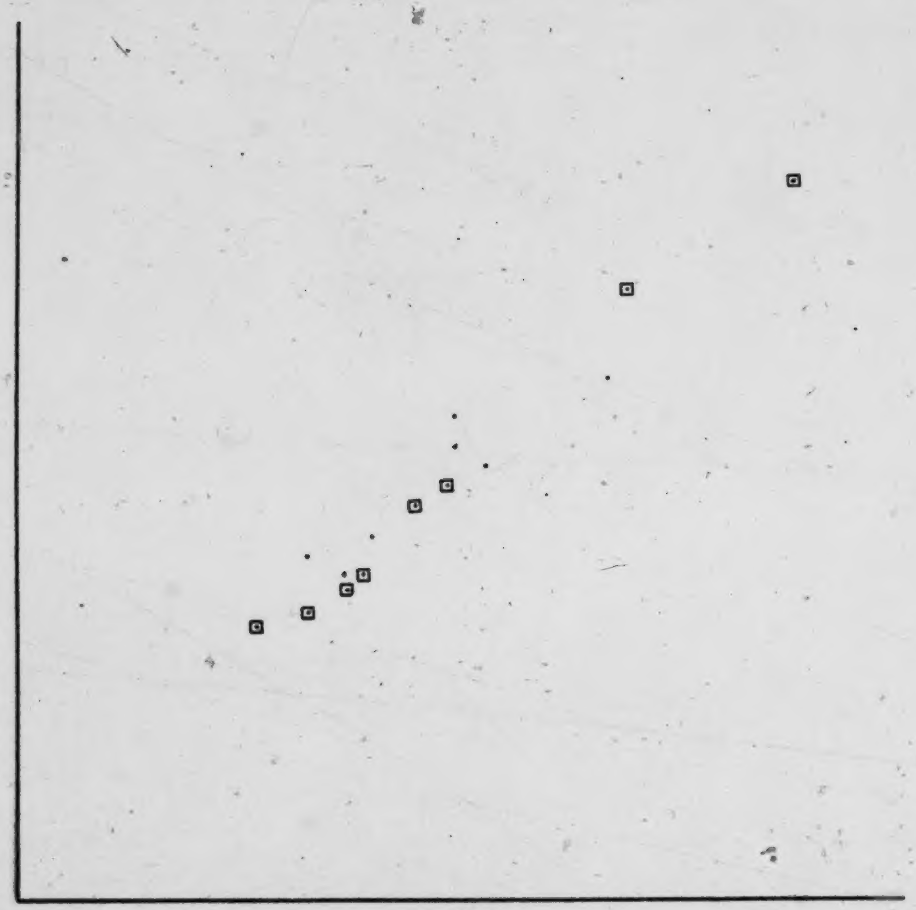
19.1	16.6	2.5	17.85
18.4	18.5	.1	18.45
20.8	20.0	.8	20.4
24.0	23.4	.6	23.7
26.8	24.9	1.9	25.85
27.5	24.8	2.7	26.15

$\bar{x}$ = 23.4
S.D. = 4.9

Cemetery (various dates)
(G)

1923:	18.2	17.7	.5	17.95
1923:*	40.7	44.0	3.3	42.35
1929:	16.3	16.3	——	16.3
1930:	18.2	19.1	.9	18.65
1936:*	34.7	33.4	1.3	34.05
1938:	22.1	22.6	.5	22.35
1941:	15.2	13.4	1.8	14.3
1949:	23.5	24.4	.9	23.95

*(Swedish Black Granite)

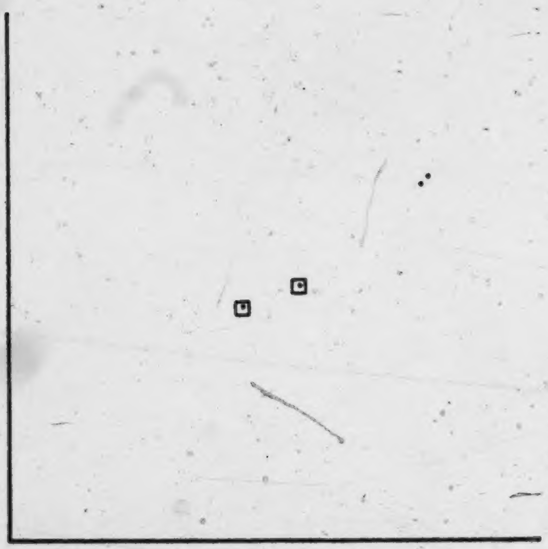


DjMr-1
(G)

20.7	23.2	2.5	21.95
20.6	23.8	3.2	22.2

Cemetery, (various dates)
(G)

1919:	14.2	16.1	1.9	15.15
1927:	13.1	13.1	—	13.1



DgNc-1
(Q)

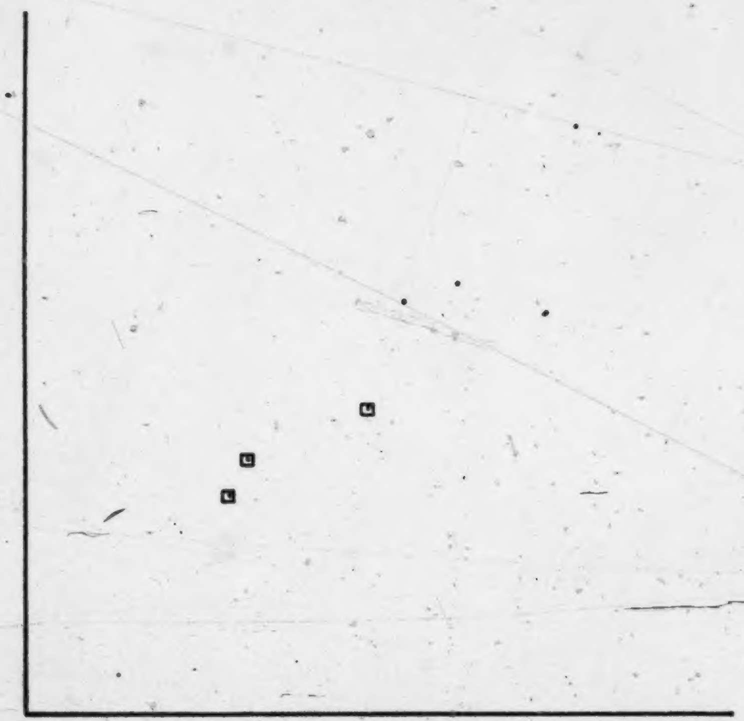
23.7	21.5	2.2	22.6
24.6	24.6	—	24.6
22.9	29.1	7.2	26.0
33.4	31.4	2.0	32.4

$\bar{x}$ = 26.4
S.D. = 4.2

Rockpile, ca. 1911
(Q)

12.7	11.1	1.6	11.9
14.9	12.8	2.1	13.85
17.4	19.1	1.7	18.25

$\bar{x}$ = 14.7
S.D. = 3.2



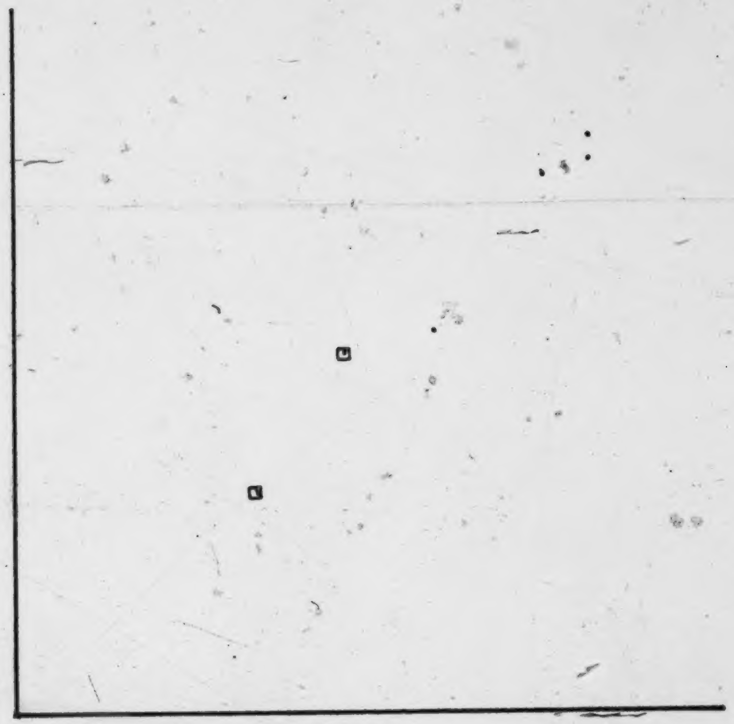
DgNf-5
(Q)

21.5	23.7	1.2	22.6
30.3	30.0	.3	30.15
31.4	32.7	1.3	32.05
32.7	32.1	.6	32.4

$\bar{x} = 28.28$
S.D. = 6.3

Rockpile, ca. 1926
(Q) - same data as DgNg-2

12.8	13.4	.6	13.1
20.1	18.6	1.5	19.35



DgNf-5
(G)

23.2	22.8	.4	23.0
24.0	28.9	4.9	26.45
36.7	34.1	2.6	35.4

Rockpile, ca. 1926
(G) - same data as DgNg-2 :

12.9	12.7	.2	12.8
14.1	13.7	.4	13.9
15.6	15.7	.1	15.65
17.1	14.3	2.8	15.7

$\bar{x}$ = 14.5
S.D. = 1.24

DgNg-2
(Q)

26.0	21.4	4.6	23.7
24.2	28.6	4.4	26.4
22.1	33.7	11.6	27.9
25.9	32.1	6.2	29.0
29.1	29.1	—	29.1
32.6	31.1	1.5	31.85
34.0	39.3	5.3	36.65
40.0	45.4	5.4	42.7

$\bar{x}$ = 30.9
S.D. = 6.0

Rockpile, ca. 1926
(Q)

12.8	13.4	.6	13.1
20.1	18.6	1.5	19.35

DgNg-2
(G)

25.9	24.6	1.3	25.25
26.8	27.7	.9	27.25
27.1	30.2	3.1	28.65
30.6	30.4	.2	30.5
32.8	31.6	1.2	32.2
33.6	33.1	.5	33.35
37.2	34.8	2.4	36.0

$\bar{x}$ = 30.5
S.D. = 3.7

Rockpile, ca. 1926
(G)

12.9	12.7	.2	12.8
14.1	13.7	.4	13.9
15.6	15.7	.1	15.65
17.12	14.3	2.8	15.7

$\bar{x}$ = 14.5
S.D. = 1.24

DgNh-3
(Q)

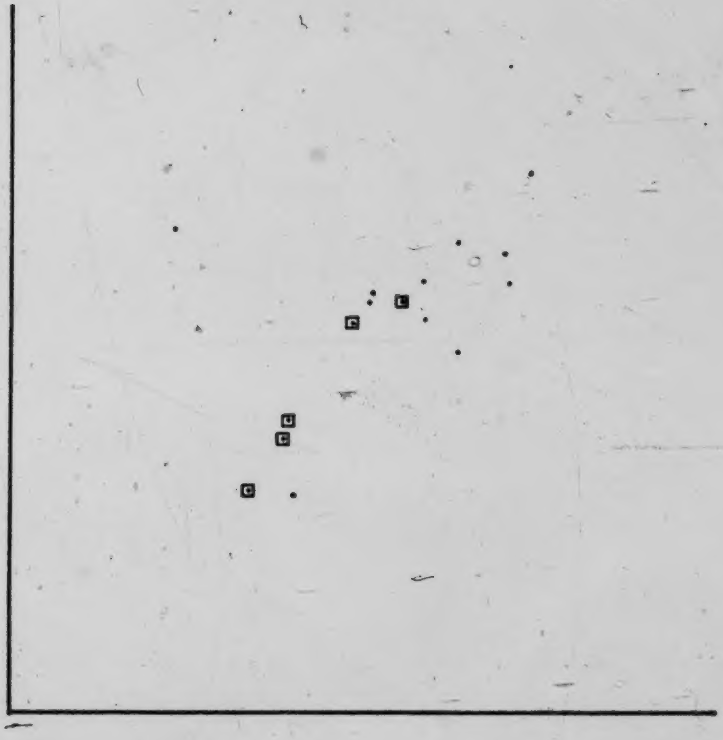
12.4	16.0	3.6	14.2
23.2	20.6	2.6	21.9
23.4	20.4	3.0	21.9
20.5	25.2	4.8	22.9
22.4	23.7	1.3	23.05
24.8	23.6	1.2	24.2
26.4	25.3	1.1	25.85
24.4	28.9	4.5	26.65
26.0	28.0	2.0	27.0
30.4	29.6	.8	30.0

$\bar{x}$ = 23.76
S.D. = 4.2

Rockpile, ca. 1913
(Q)

12.6	13.9	1.1	13.35
15.6	16.3	.7	15.95
16.6	15.8	.8	16.2
22.2	19.7	2.5	20.95
23.7	22.9	.8	23.3

$\bar{x}$ = 17.95
S.D. = 2.5



DiNf-1
(Q)

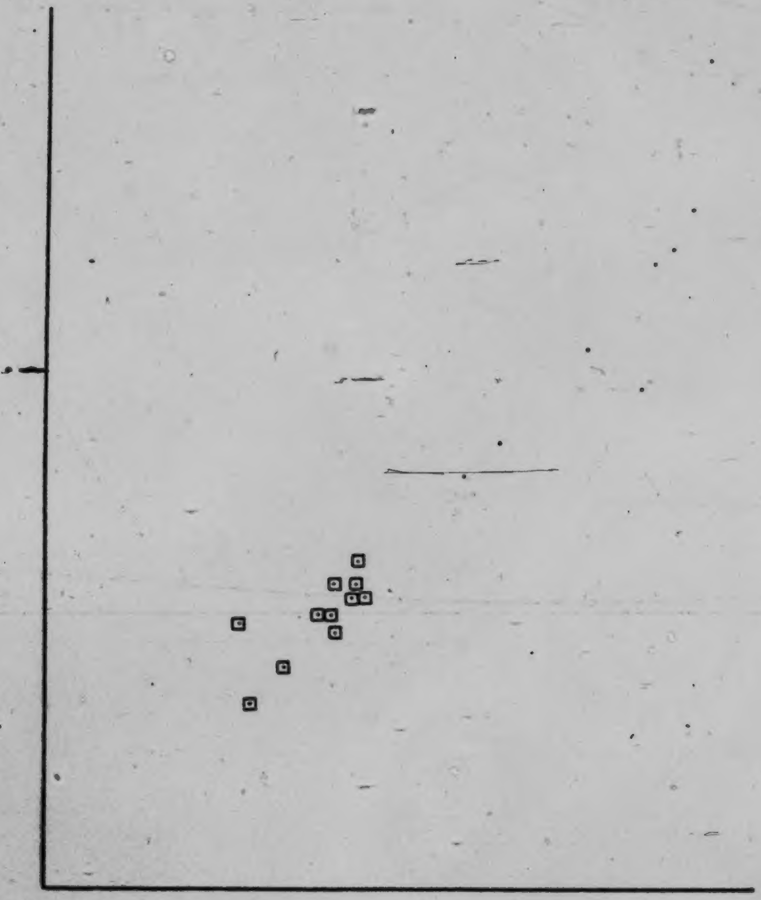
23.6	23.4	.2	23.5
25.7	25.6	.1	25.65
30.6	30.7	.1	30.65
28.6	33.7	5.1	31.15
35.6	34.2	1.4	34.9
36.4	35.6	.8	36.0
38.8	36.8	2.0	37.8
47.0	37.6	9.4	42.3

$\bar{x}$ = 32.7
S.D. = 5.9

Rockpile, ca. 1915
(Q)

11.5	11.6	.1	11.55
12.9	13.3	.4	13.1
15.0	13.0	2.0	14.0
15.7	15.1	.6	15.4
14.9	16.4	1.5	15.65
15.6	15.9	.3	15.75
17.7	16.2	1.5	16.95
16.5	17.6	1.1	17.05
17.2	17.1	.1	17.15
16.8	17.5	.7	17.15
18.7	17.9	.8	18.3

$\bar{x}$ = 15.6
S.D. 2.03



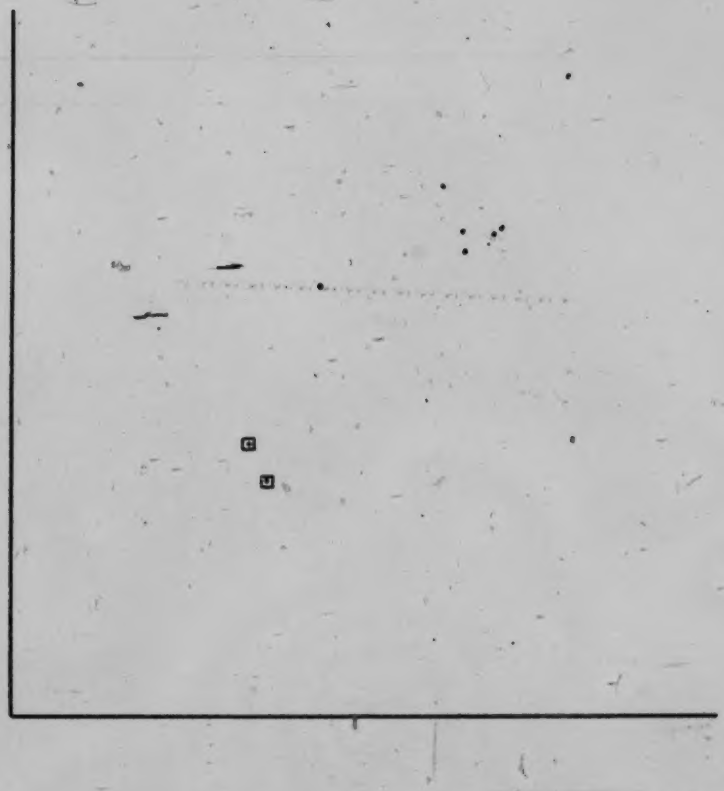
DiNf-1
(G)

24.7	17.3	7.4	21.0
26.2	25.1	1.1	25.65
27.9	25.6	2.3	26.75
30.0	24.3	5.7	27.15
27.6	27.4	.2	27.5
27.7	27.8	.1	27.75
36.2	31.8	4.4	34.0

$\bar{x}$ = 27.11
S.D. = 3.82

Rockpile, ca. 1915
(G)

15.2	13.1	2.1	14.15
13.7	14.9	1.2	14.3



DkOe-2
(Q)

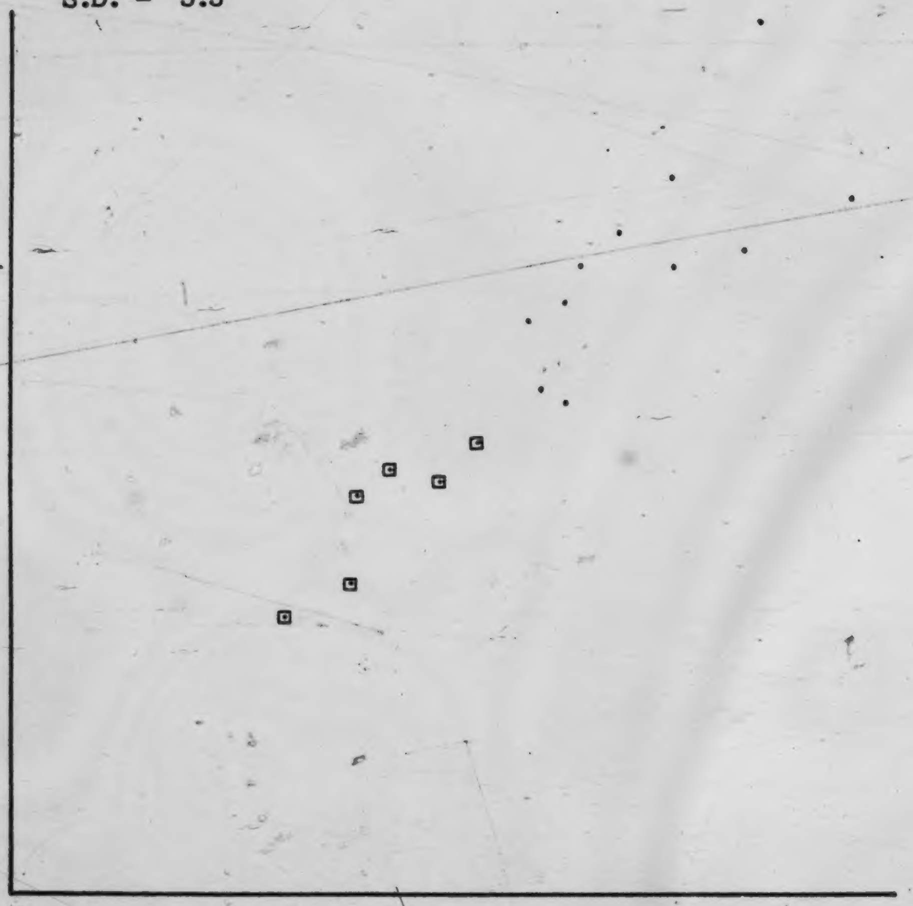
28.6	30.0	1.4	29.3
28.0	31.2	3.2	29.6
32.8	29.2	3.6	31.0
33.2	31.1	2.1	32.15
35.3	32.2	3.1	33.75
37.1	34.9	2.2	36.0
35.3	37.7	2.4	36.5
36.7	41.3	4.6	39.0
41.2	37.3	3.9	39.25
39.6	47.2	7.6	43.4
49.7	42.2	7.5	45.95

$\bar{x}$ = 35.99
S.D. = 5.5

Rockpile, ca. 1910
(Q)

15.4	16.2	.8	15.8
17.1	19.0	1.9	18.05
22.4	19.8	2.6	21.1
24.0	21.8	2.2	22.9
23.7	24.9	1.2	24.3
25.6	26.8	1.2	26.2

$\bar{x}$ = 21.39
S.D. = 3.8



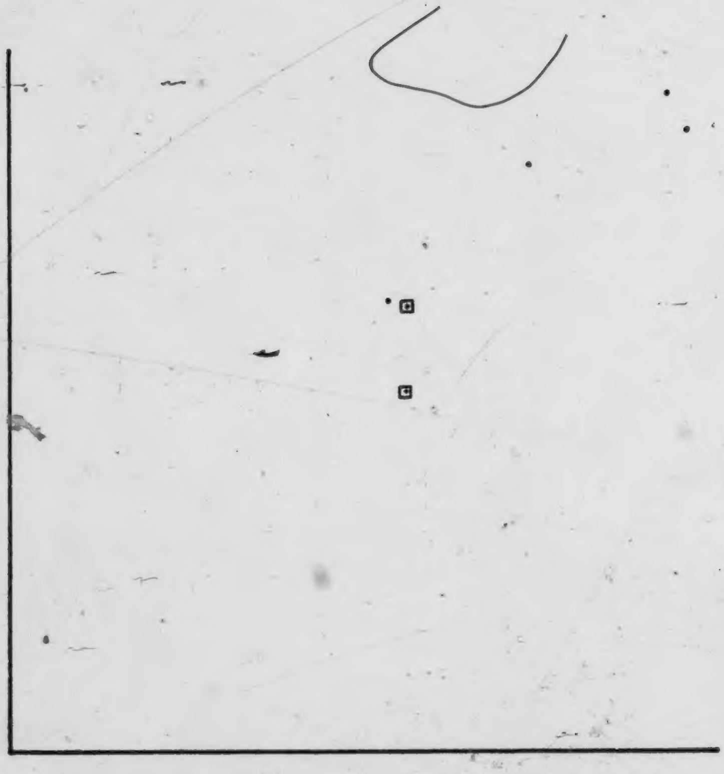
DkOj-2
(Q)

25.9	21.4	4.5	23.65
33.7	29.8	3.9	31.75
35.6	38.3	2.7	36.95
37.4	37.6	.2	37.5
38.7	42.4	3.1	40.55

$\bar{x}$ = 34.08
S.D. = 6.7

Rockpile, ca. 1913
(Q)

20.8	22.4	1.6	21.6
25.3	22.7	2.6	24.0



DkOj-2
(G)

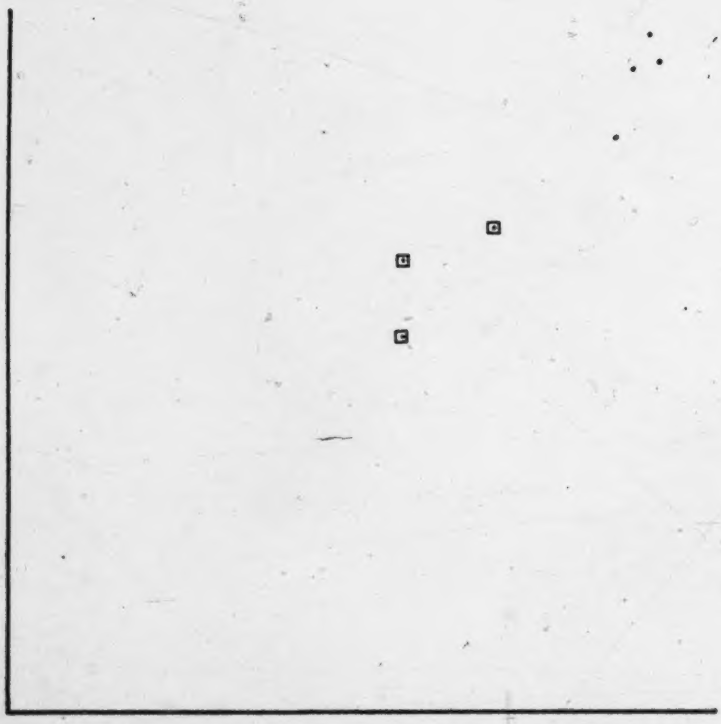
32.9	34.4	1.5	33.65
36.5	35.4	1.1	35.95
37.0	37.0	—	37.0
38.2	36.2	2.0	37.2
40.7	36.9	3.8	38.8
45.7	49.7	4.0	47.7

$\bar{x}$ = 38.38
S.D. = 4.8

Rockpile, ca. 1913
(G)

21.3	22.8	1.5	22.05
25.1	22.4	2.7	23.75
27.4	27.4	—	27.4

$\bar{x}$ = 24.4
S.D.= 2.7



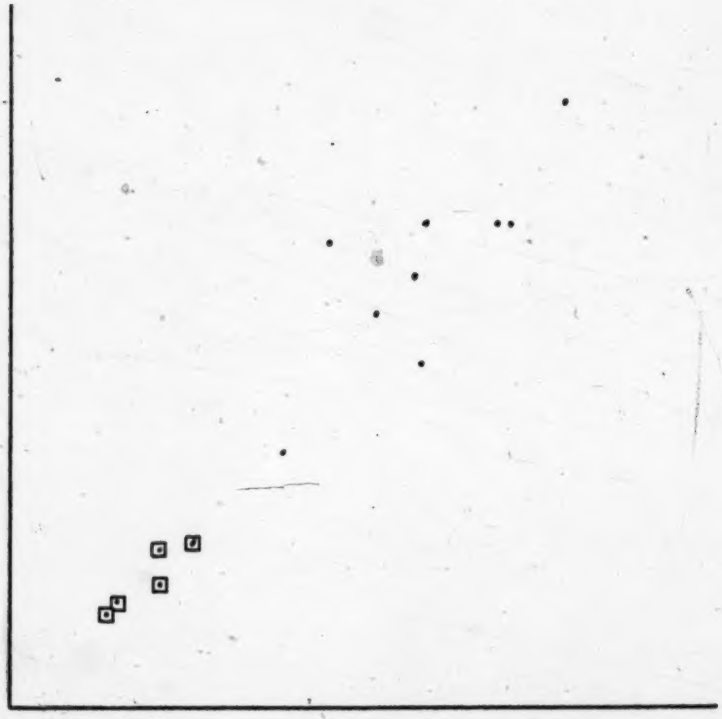
EaNh-7
(G)

14.1	15.1	1.0	14.6
19.3	23.3	4.0	21.3
22.2	20.7	1.5	21.45
26.1	18.0	8.1	22.05
24.9	23.0	1.9	23.95
27.8	23.5	4.3	25.65
27.6	27.6	—	27.6
27.1	28.2	1.1	27.65
34.6	31.1	3.5	32.8
57.9	40.0	17.9	48.95

$\bar{x}$ = 26.6
S.D. = 9.2

Cemetery (various dates)
(G)

1918:	9.1	10.1	1.0	9.6
1923:	9.0	8.4	.6	8.7
1929:	6.0	6.0	—	6.0
1941:	5.6	5.4	.2	5.5
1943:	7.0	8.3	1.3	7.65



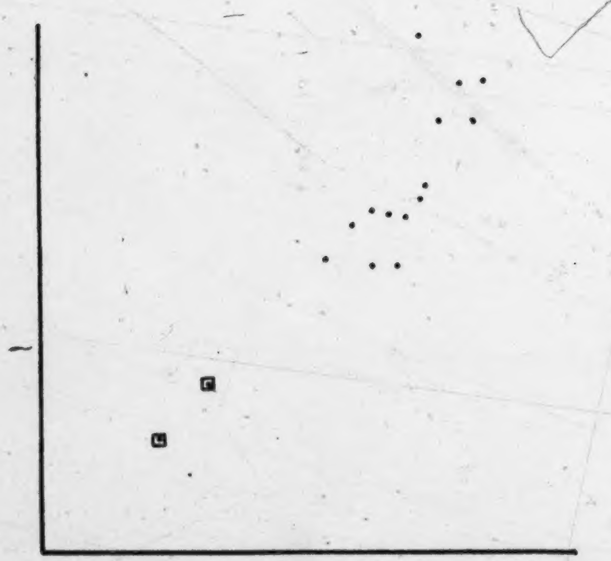
EcNh-1
(Q)

16.2	16.0	.2	16.1
16.0	18.9	2.9	17.45
18.2	17.5	.7	17.85
16.0	20.0	4.0	18.0
19.0	19.2	.2	19.1
19.8	18.4	1.4	19.1
19.0	20.1	1.1	19.65
20.0	21.2	1.2	20.6
20.6	21.9	1.3	21.25
24.9	22.2	2.7	23.55
24.7	24.8	.1	24.75
26.5	23.8	2.7	25.15
29.6	21.6	8.0	25.6
26.9	25.0	1.9	25.95

$\bar{x}$ = 21.00
S.D. = 3.4

Rockpile, ca. 1938
(Q)

6.7	6.7	—	6.7
9.8	9.6	.2	9.7

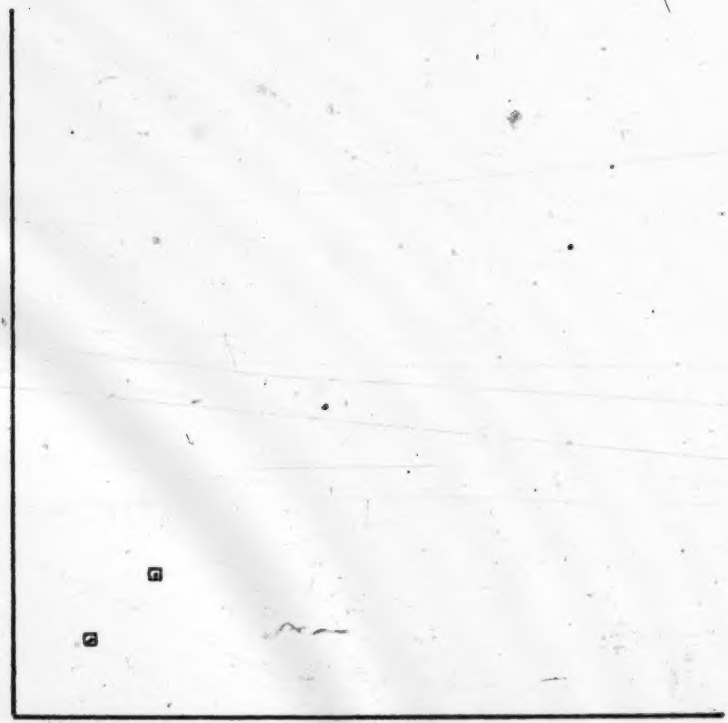


EcNh-1
(G)

17.9	17.3	.6	17.6
26.9	31.8	4.9	29.35

Rockpile, Ca. 1938
(G)

4.3	4.1	.2	4.2
8.0	8.0	—	8.0



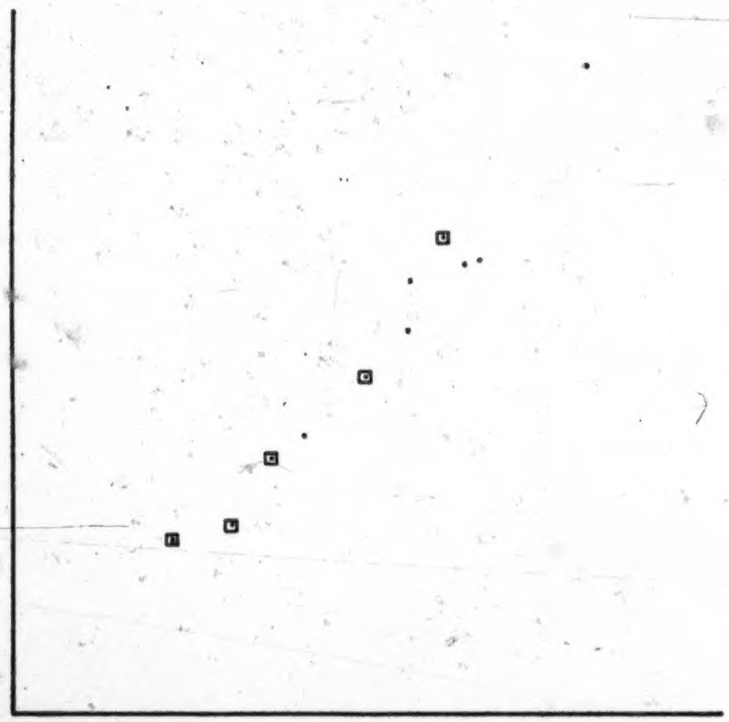
EeNe-14
(G)

15.9	16.4	.5	16.15
21.9	22.1	.2	22.0
24.2	22.6	1.6	23.2
25.4	25.2	.2	25.3
25.9	26.1	.2	26.0
36.3	32.1	4.2	34.2
46.2	39.7	6.5	42.95

$\bar{x}$ = 27.11
S.D. = 8.82

Cemetery (various dates)
(G)

1911:	9.8	9.0	.8	9.4
1919:	19.0	20.0	1.0	19.5
1938:	27.0	24.3	2.7	25.65
1938:	14.3	14.7	.4	14.5
1940:	10.9	7.1	3.8	9.0



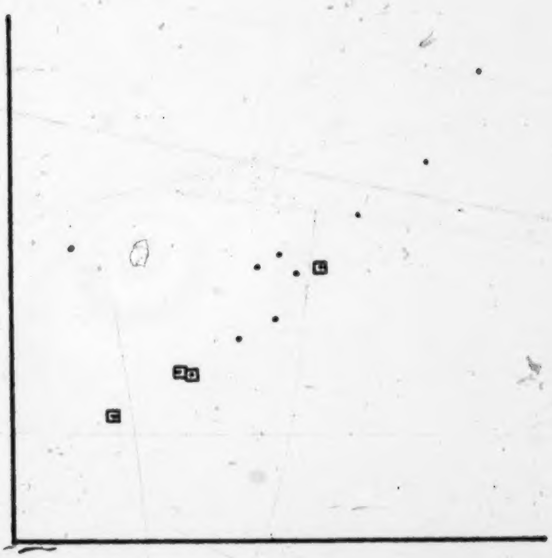
EeNg-1
(G)

11.4	12.7	1.3	12.05
12.4	14.9	2.5	13.65
15.1	13.9	1.2	14.5
16.4	13.1	3.3	14.75
15.0	16.0	1.0	15.5
16.0	15.0	1.0	15.5
18.1	19.2	1.1	18.65
21.1	23.1	1.9	22.15
26.7	26.4	.3	26.55

$\bar{x}$ = 17.0
S.D. = 4.2

Cemetery (various dates)
(G)

1935:	9.4	10.0	.6	9.7
1935:	9.8	9.7	.1	9.75
1935:	11.7	13.0	1.3	12.35
1935:	15.1	17.2	2.1	16.15
1936:	7.0	5.9	1.1	6.45



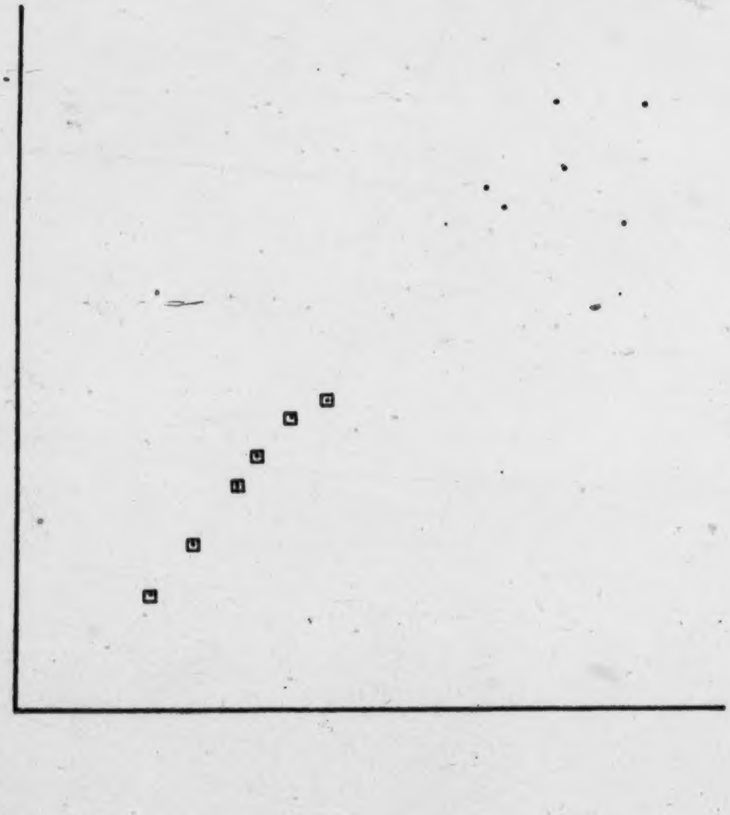
EgNx-1
(G)

28.7	27.2	1.5	27.95
29.9	26.8	3.1	28.35
30.8	31.0	.2	30.9
34.1	30.7	3.4	32.4
34.1	35.1	1.0	34.6

$\bar{x}$ = 30.84
S.D. = 2.7

Cemetery, (various dates)
(G)

1918:	14.3	13.2	.9	13.75
1918:	12.9	12.4	.5	12.65
1924:	9.1	10.0	.9	9.55
1925:	17.1	17.8	.7	17.45
1935:	6.7	7.1	.4	6.9
1937:	16.6	15.8	.8	16.2



EfO1-2
(Q)

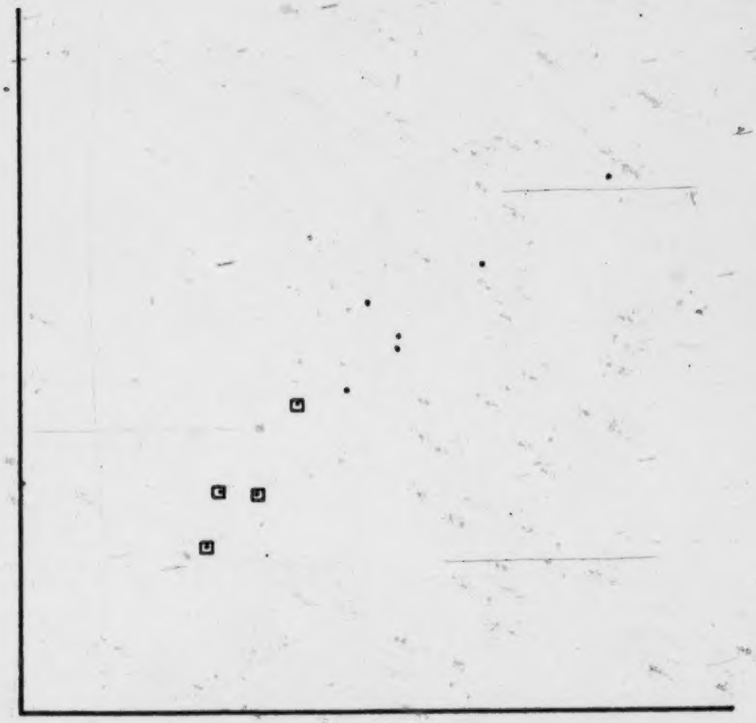
36.8	37.4	.6	37.1
41.8	42.3	.5	42.05
46.4	39.9	6.5	43.15
43.6	43.6	——	43.6
54.1	52.1	2.0	53.1
60.9	67.3	6.4	64.1

$\bar{x}$ = 47.18
S.D. = 9.7

Rockpile, ca. 1925
(Q)

19.0	21.7	2.7	20.35
25.3	22.2	3.1	23.75
24.6	26.9	2.3	25.75
35.4	31.7	3.7	33.55

$\bar{x}$ = 25.85
S.D. = 5.6



EfO1-2
(G)

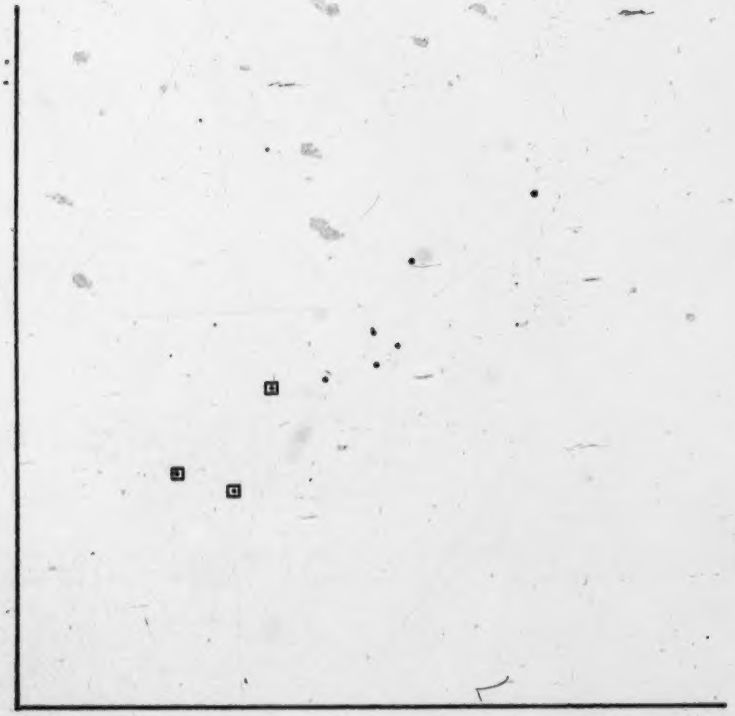
37.3	35.2	2.1	36.25
38.4	40.8	2.4	39.6
42.4	40.7	1.7	41.55
41.8	43.4	1.6	42.6
51.7	45.4	6.3	48.55
58.7	58.5	.2	58.6

$\bar{x}$ = 44.53
S.D. = 7.94

Rockpile, ca. 1925
(G)

26.7	19.0	7.7	22.85
24.1	24.1	——	24.1
36.2	28.2	8.0	32.3

$\bar{x}$ = 26.38
S.D. = 5.1



E10d-2
(Q)

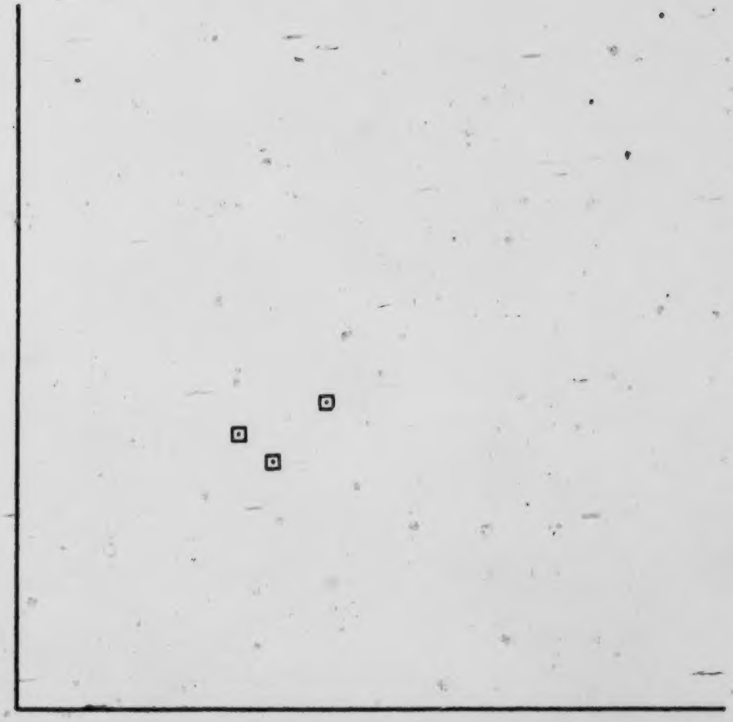
31.5	34.7	3.2	33.1
34.9	32.4	2.5	33.65
39.4	36.1	3.3	37.75

$\bar{x}$ = 34.8
S.D. = 2.54

Rockpile, ca. 1920
(Q)

14.0	14.3	.3	14.15
15.6	12.7	2.9	14.15
17.4	17.2	.2	17.3

$\bar{x}$ = 15.2
S.D. = 1.8



E10d-2
(Q)

21.9	24.1	2.2	23.0
23.2	23.2	—	23.2
28.3	27.6	.7	27.95
36.2	29.3	6.9	32.75

$\bar{x}$ = 26.73
S.D. = 4.61

Rockpile, ca. 1920
(Q)

11.5	14.2	2.7	12.85
15.0	15.5	.5	15.25